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**THE STANDARD CYCLOPEDIA OF
HORTICULTURE**



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LXXXI. Ray peach.

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THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY
L. H. BAILEY

*Illustrated with Colored Plates, Four Thousand Engravings in the Text,
and Ninety-six Full-page Cuts*

IN SIX VOLUMES
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P

PACHIRA (native Guiana name). *Bombacaceæ*. A group of tropical American trees of variable size, some of which are known to be deciduous, all with striking showy flowers and exceptionally large fruits.

Calyx almost tubulose, mostly short, truncate; staminal column long, divided at the top into 5 short branches, each of which in its turn ends more or less regularly in 3 bundles of about 15 stamens, with unequal slender filaments: caps. dehiscent, rounded-depressed to elongate-oblong, 5-celled, each cell containing several seeds coated in fleshy tissue. Allied genera are *Bombax* and *Adansonia*; the first one differs in having the small seeds imbedded in the woolly inside lining of the caps. (whence their name of silk cotton trees), the latter

(the African baobab) in its 5-lobed calyx. In *Bombax*, the arrangement of the stamens is distinct and their number much greater.—Over 30 species of *Pachira* have been listed, of which at least 3 belong to *Bombax*, 4 are synonyms, and among the remainder several are likely to be dropped on one account or another. Botanically speaking, only 7 species are well known, all of which may be distributed into 3 main groups. The fls. may reach 13 in. long with a spread of 9 in. in certain species; the petals are narrow and gracefully recurved in some cases, obovate and somewhat stiff in others. The color varies from a rich pink to white or pale brownish yellow, distinct shades occurring in every species. The digitate foliage also contributes to give the trees their peculiar appearance. As to distribution, *P. aquatica* is found all over Trop. Amer., 3 species are restricted to Cent. Amer., 2 to the W. Indies, and the others are natives of S. Amer. They are easily cult. under glass and prop. either by seeds or cuttings, but, on account of their large size, most species are hardly desirable for conservatories. One species, *P. insignis*, has edible seeds, alike in size and flavor to the chestnut and on which account it is sometimes cult. in Venezuela and some of the Lesser W. Indies. The seeds of *P. macrocarpa* are sometimes used as a cacao substitute; it is probably the xiloxochitl of the Aztecs, being still called by that name (jelinjoche) in Nicoya (Costa Rica).

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A. Caps. globose-depressed, i.e., its diam. greater than its length. (*Brachycarpæ*.)

insignis, Savigny (*Carolinea princeps*, Linn. f.). A small tree: lvs. 5-7-foliolate, the lfts. glabrous, subsessile, oblong, 8-24 in. long; fls. 7 in. long, erect; calyx cup-like, short and broad; petals obovate, long-cuneate, crimson or dark purple, covered without with a thick brownish down; staminal tube short, the stamens not reaching the end of the corolla: caps. about 5 in. long by 7 in. diam. Trinidad and Lesser W. Indies; also in Venezuela. J.F. 3:295.

AA. Caps. ovate-rounded, its diam. more than half the length. (*Mesocarpæ*.)

B. Calyx covered with large, crater-like glands: fls. sessile.

pustulifera, Pittier. A small tree: lvs. 7-foliolate; lfts. briefly petiolulate, ob-ovate, $4\frac{1}{2}$ -9 in. long, minutely tomentose beneath: fl. about 7 in. long; calyx stipitate, truncate, pubescent within and irregularly covered with large glands without; petals lacinate, pinkish, yellowish pubescent without; staminal tube short, pubescent, the stamens much shorter than petals: caps. 10 in. long by 8 in. diam. Costa Rica.

BB. Calyx smooth or with only a few glands at the base: fls. pedunculate.

macrocarpa, Schlecht. (*P. fastuosa*, Decne. *P.*

longifolia, Hort.). Fig. 2694. A small or medium-sized tree: lvs. 5-7-foliolate; lfts. subsessile or briefly petiolulate, oblong or obovate, $2\frac{1}{2}$ -8 in. long, glabrous: fls. up to 9 in. long; calyx stipitate, cuplike, smooth or nearly so; petals lacinate or linear, brownish to greenish pubescent without, pink to white or pale yellow within; staminal tube glabrous, the stamens about as long as the petals: caps. ovoid, 9 in. long by 8 in. diam. Cent. Amer., from Mex. to Costa Rica. B.M. 4595. G.C. III. 54: 325. J.F. 2:109, 110.

villósula, Pittier. A tree reaching 90 ft.: lvs. 5-7-foliolate; lfts. petiolulate, obovate or elliptic-lanceolate, 2-7 in. long, villous beneath: fl. up to 10 in. long; calyx funnel-shaped, truncate, ferruginose-pubescent outside; petals lacinate, pubescent on both faces, pinkish



2694. *Pachira macrocarpa*.

(2423)

within, rusty colored without; staminal tube long, pubescent, the stamens shorter than the petals: caps. ovoid, 7 in. long by 5 in. diam. Panama.

AAA. Caps. ovate-elongated, its diam. less than half the length. (*Dolichocarpæ*.)

B. Fls. hardly over 4 in. long.

púlcra, Planch. & Lind. A small tree: lvs. 7-foliate; lfts. briefly petiolulate, cuneate-oblong or lanceolate, glabrous: fl. about 4 in. long; calyx cup-like, tomentose-pubescent outside; petals linear-oblong, greenish pink within, tomentose and brownish without; staminal tube short, the stamens hardly as long as the petals: caps. not known. Ocaña Mts., Colombia.

BB. Fls. 10 in. long or more.

speciosa, Triana & Planch. A tree about 150 ft. high: lvs. 7-foliate; lfts. briefly petiolulate, cuneate-oblong, glabrous, 4-8 in. long: fl. about 10 in. long; calyx cuplike, brownish pubescent without; petals oblong, long-attenuated, yellowish white inside, minutely tomentellose outside; staminal tube long, pubescent without, the white stamens nearly as long as the petals: caps. not known. Colombia.

aquatica, Aubl. (*P. grandiflora*, Tussac). A small tree: lvs. 5-7 (9) foliolate; lfts. subsessile, obovate to elliptic-lanceolate, glabrous, 4-12 in. long: fls. 8½-14 in. long; calyx tubulose-truncate, often warty at the base; petals lacinate, more or less deeply pinkish or purplish; staminal tube long, the red or scarlet filaments about as long as the petals: caps. 7-15 in. long, 3-5 in. diam. Trop. Amer., including W. Indies. G.C. III. 40:308.—*P. aquatica* varies considerably according to the nature of the soil in which it grows and to its environment, and it is not unlikely that most so-called species described in horticultural reviews should be considered as simple varieties of the same. This species is the best known in the genus and its area of distribution is very extensive; its cult. in hothouses has been often attempted and it has lately been intro. in Fla. under the name of *P. insignis*. *P. stenopetala*, in Gt. 9:302, is probably a cult. form of *P. aquatica*.

P. alba, Walp., is evidently a Bombax. B.M. 4508. Generally speaking, there is a great confusion as to the identification of the several species, most of which are not represented even in the larger herbaria.—*P. minor*, Hemsl., known to us only by a poorly executed plate in B. M. 1412, may be a variety of *P. aquatica*.

H. PITTIER.

PACHYSTIMA (said to be derived from Greek, *pachys*, thick, and *stigma*; alluding to the slightly thickened stigma). Spelled also *Pachystima* and *Pachy-*

stigma. *Celastraceæ*. Ornamental woody plants sometimes grown for their evergreen foliage.

Low evergreen shrubs: branchlets somewhat quadrangular, verrucose: lvs. opposite, small, serrulate or entire, short-petioled, with minute deciduous stipules: fls. perfect, small, in few-fl. axillary cymes; calyx-lobes, petals and stamens 4; ovary 2-celled, often only 1 cell developing into a small, oblong, 1-seeded caps.—Two species in the mountains of N. Amer.; allied to *Evonymus*.

These are low trailing or spreading shrubs with small evergreen foliage and inconspicuous reddish flowers followed by small dull-colored capsules. They are hardy with slight protection in the Arnold Arboretum, Boston, and are handsome dwarf evergreens for rockeries or rocky slopes; *P. Canbyi* forms a dense carpet and may be used as a border plant for evergreen shrubberies. They seem to grow in any well-drained soil. Propagation is by seeds or by layers; also by cuttings of half-ripened wood under glass, and *P. Canbyi* also by division.

myrsinites, Raf. (*Myginda myrtifolia*, Nutt. *Oreophila myrtifolia*, Nutt.). Spreading shrub, to 2 ft.: lvs. broadly elliptic to oblong-obovate, slightly revolute at the margin and serrulate or almost entire, ½-1 in. long: fls. short-stalked, reddish: fr. about ½ in. long. May-July. Brit. Col. to Calif. and N. Mex.—Resembles the small-ld. form of *Evonymus radicans*, but of more rigid and stiff growth.

Canbyi, Gray. Dwarf shrub with trailing and rooting branches, scarcely exceeding 1 ft.: lvs. narrow-oblong, occasionally obovate, revolute and usually serrulate above the middle, ¼-¾ in. long: fl.-stalks filiform, longer than half the lf.; fls. reddish. April, May. Mts. of Va.—This is somewhat similar in habit and foliage to *Evonymus nanus*, but less vigorous and of more even and regular growth. Sometimes called rattripper.

ALFRED REHDER.

PACHYCEREUS (Greek, *thick* and *cereus*). *Cactaceæ*. Usually trees, more or less branched, with very definite woody trunks.

Flowers appearing during the day, with rather short tubes; petals short; stamens included; ovary and tube of fl. covered with small bracts bearing wool, hairs, and bristles in their axils: fr. large, burlike; seeds large and black.—The genus consists of 10 species segregated from *Cereus*. Confined to the drier parts of Mex. Cult. as for *Cereus* and related groups; see *Succulents*. This genus is closely related to *Lemaireocereus*, one of the several segregates of *Cereus*; *C. queretarensis*, Web., is *Lemaireocereus queretarensis*, Brit. & Rose, rather than a *Pachycereus* (see page 1836, Vol. IV).

chrysomallus, Brit. & Rose (*Pilocereus chrysomallus*, Lem.). Tree-like, with erect branches, reaching a height of 30 ft.: ribs in cult. plants 13: areoles with long hairs; radial spines 11-13, the upper ½ in. long, the lower twice as long; centrals 4, still longer; all the spines amber-yellow, becoming brown: cephalium terminal or sometimes unilateral, a foot long, woolly and setose. Mex.—The indications are that the plant in cult. under the above name is a true *Cephalocereus* and not the *Pilocereus chrysomallus* of Lemaire.



2695. *Pachycereus Pringlei*.

Columna-Trajani, Brit. & Rose (*Pilocereus Columna-Trajani*, Salm-Dyck). **TRAJAN'S COLUMN**. Treelike, attaining a height of 50 ft. and a diam. of over 2 ft., simple below: areoles large, elliptic; radial spines 10-12, the upper very short, the lower longest, nearly an inch long; centrals 2, the upper an inch long, the lower 4-5 in.: fls. about 2 in. long, scarcely projecting from the unilateral woolly and bristly cephalium. Mex. R.H. 1890, p. 129.—The specific name refers to the famous Trajan's Column.

marginatus, Brit. & Rose (*Cereus marginatus*, DC. *C. gemmatus*, Zucc.). Simple or branching at apex, 2-3 in. diam., with 5-6 obtuse ribs, which are woolly their whole length: spines short-conical, rigid, 7-9, all nearly alike: fls. brownish purple, about 1½ in. long; fr. globular and spiny. Mex.—Frequently used for hedges in S. Mex. The st. is often covered with a woody crust.

pecten-aboriginum, Brit. & Rose (*Cereus pecten-aboriginum*, Engelm.). This species is sometimes cult. but does not do well under glass. The large burry frs. used by the Sonoran Indians for hair-brushes are sometimes seen in museums and curio stores.

Pringlei, Brit. & Rose (*Cereus Pringlei*, Wats.). Fig. 2695. One of the cordon cereuses of N. Mex. Not so tall as *Carnegiea gigantea*, ribs, fewer, and fls. scattered. Not in cult. G.F. 2:65 (adapted in Fig. 2695).

J. N. ROSE.

PACHYPHYTUM (Greek, *thick plant*). *Crassulaceae*. Succulents, likely to be found in the under-glass collections of amateurs, and out-of-doors far South. See page 870, Volume II.

Cauliscent, more or less branched, with very thick lvs. which are often terete: fls. solitary or in second racemes; calyx deeply lobed, the lobes shorter than the corolla, and appressed to it; corolla 5-7-parted and not at all 5-angled; petals erect below, spreading above; stamens 10, the 5 alternating with the petals free from the corolla, the other 5 borne on the petals each usually with a pair of appendages at the base; scales broad: carpels 5, erect, free to the base.—About 7 species from Mex. *Pachyphytum* is usually included in *Cotyledon* but some recent American botanists keep the genus distinct. *P. uniflorum*, Rose, is a stout species usually woody below with green hardly glaucous terete lvs., appendaged stamens and acute calyx-lobes, said to be cult. in shady courtyards at San Luis Potosi, Mex. *P. bracteosum*, Klotzsch (*Echeveria bracteosa*, Lindl. & Pax.). This species has oblanceolate to spatulate thickish lvs. and a curved, finally erect, second raceme which is 12-18-fl.: its calyx is deeply campanulate with unequal lobes and a bright red corolla. Mex. B.M. 4951.

PACHYPEDIUM (Greek, *thick foot*, alluding to the roots). *Apocynaceae*. About 15 remarkable succulent shrubs and trees of Madagascar, S. Afr. and Trop. Afr., a very few of which are mentioned in horticultural literature. They are grown with succulents, and prop. by cuttings. Frequently the trunk is much swollen: lvs. simple, in spirals; stipules represented by rigid spines; or, according to Stapf, the lvs. suppressed with the exception of a terminal rosette, and the spinous stipules crowded more or less irregularly on the swollen branches: cymes terminal, with few or many sessile or peduncled pink, white or yellow fls.; sepals 5; corolla salver-shaped, constricted at base, or funnelform to campanulate, 5-lobed; anthers conniving into a cone, with appendages longer or shorter than the pollen-bearing part, the structure complex. *P. Gedayi*, Cost. & Bois. Tree, 30 ft. or more, with succulent cactus-like spiny trunk, branching at summit: lvs. in terminal tufts, long and narrow. Madagascar. R.H. 1907, p. 490. *P. namaquandum*, Welw. St. 5-6 ft. high and 9-15 in. diam., fleshy, tapering upward, tubercled and spiny: lvs. obovate-oblong to oblong, crowded in a little

crown at the top of the trunk: fls. reddish tinged yellow and green. S. Afr. G.C. III. 46:371, showing the strange plants in the wild. *P. succulentum*, DC. Tuberos at base, 1-2 ft. high, producing several somewhat branched sts., bearing lvs. scattered on long shoots: lvs. oblong-linear or linear, 1½ in. long, pubescent above; stipules spiny: fls. 1 in. or more across, the oblong lobes white and purple. S. Afr. L. H. B.

PACHYRHIZUS (Greek, *thick*, and *root*). *Leguminosae*. Climbing herbs bearing large tuberous roots often 6 to 8 feet long and weighing fifty to seventy pounds, which are used for food and as a source of starch.

Leaves pinnately 3-foliolate; lfts. stipellate, lobed, 3-4 in. wide: racemes with swollen nodes and fascicled pedicels, bracts and bractlets setaceous, caducous; calyx 2-lipped, limb as long as the tube, upper lip emarginate, lower lip deeply 3-lobed; corolla much exserted, petals subequal, keel obtuse; stamens diadelphous; anthers uniform; ovary sessile, many-ovuled; style long, circinate at the apex, bearded down the inner side below the very oblique stigma: pod large linear, turgid, deeply depressed between the seeds.—A genus of 3 or 4 species distributed throughout the tropics of both hemispheres. Blanco, *Flora de Filipinas*, describes and figures the roots as turnip-shaped. When young, the roots are palatable.

A. Lfts. entire.

erdsus, Urban (*Dolichos erdsus*, Linn. *D. bulbosus*, Linn. *P. bulbosus*, Kurz. *P. angulatus*, Rich. *Cacara erdsa*, Kuntze). **YAM BEAN**. Root tuberous: st. twining, shrubby, hirsute, becoming glabrate with age: lvs. pinnately 3-foliolate, often long-petioled; stipules deltoid or ovate-lanceolate, short; terminal lft. long-pedicelled, broadly cuneate at base, deeply or shallowly lobed in the upper half; lateral lfts. oblique, short-pedicelled, stipels subulate: racemes 6-12 in. long, long-peduncled, base often branching, branches ascending; calyx ¼ in., as long as the pedicel; corolla reddish, 1 in. or more long; pod 6-9 in. long, ½-¾ in. broad, 8-12-seeded, straight glabrescent. Tropics of both hemispheres. H.I. 19:1842.—Eaten both raw and boiled.

tuberosus, Spreng. **JICAMA**. Root tuberous, much larger than the above: st. twining, 10-20 ft. long: lvs. entire or obscurely sinuate: racemes densely fld.: pod 8-12 in. long, ¾-¾ in. broad. Trop. Amer. H.I. 19:1843.—Young pods superior to many cult. beans in the absence of fibrous strings about the sutures of the pods; seeds said to be poisonous. Perhaps only a cult. form of the above species. The root is said to be a great favorite with travelers, as it quenches thirst and is nutritious. They are cut in thin slices and sprinkled with sugar. Two forms are recognized in Mex., one called *agua*, with a watery juice, and one called *leche*, with a milky juice. It is said that they



can not be distinguished except by tasting the root. To have good roots, the blossoms and seed-pods must be kept pinched off, for if they are allowed to mature the roots are not good. The roots mature in about 5 months and may be allowed to remain in the ground longer, as they become sweeter as the cold season approaches.



2697. *Pachysandra procumbens*. (Flowers $\times 1$. Leaves $\times \frac{1}{2}$.)

AA. *Lfts. lobed.*

palmatifolius, Benth. & Hook. (*Dolichos palmatifolius*, Moc. & Sessé). Fig. 2696. St. twining, glabrous or pubescent: lvs. pubescent, often long-petioled, pinnately 3-foliolate, terminal lft. broadly ovate, deeply 3-lobed, with lateral lobes often somewhat 2-lobed, lateral lfts. less deeply 2-4-lobed, lobes ovate, mucronate: fls. purplish, in long-peduncled racemes. Trop. Amer.—Not so common, root smaller and less cult. than the preceding.

P. L. RICKER.

PACHYSÁNDRA (Greek, *thick stamen*). *Buzaceæ*. Perennial herbs or subshrubs of some value as ground-cover in shade for their more or less evergreen leaves.

Stems prostrate or ascending, 6-12 in. high, from rootstocks, scaly below: lvs. alternate, usually coarsely toothed, evergreen or deciduous, 3-nerved: spikes staminate above, with a few pistillate fls. at the base of each; staminate fls. with 4 sepals and stamens and a rudimentary pistil; sepals variable in the pistillate fls.; petals none; pistil 3-celled, 2 ovules in each cell, the 3 styles spreading, filaments thick, exerted, conspicuous, usually white: seeds smooth.—Two species known: of low and dense growth, with very early fls. attractive to bees, and masses of bright green lvs. Easily prop. by division in ordinary soils. Good for rockeries.

In the vicinity of Boston, *P. procumbens* is deciduous, and is desirable only from the feature of its curious flowers borne so extremely early in the spring. The foliage is of a dingy color and deciduous, whereas *P. terminalis* is a true evergreen with thick, glossy foliage forming a dense mat, making a very desirable low-growing cover-plant, succeeding admirably either in full sun or partial shade. The variety *variegata* is a very choice cover plant for ornamental effects. (J. Woodward Manning.)

procumbens, Michx. MOUNTAIN SPURGE, Fig. 2697. One foot high or less: lvs. ovate to obovate, 2-4 in. long: spikes of white or purplish fls. from the base of the sts. March-May. W. Va. to Fla. B.M. 1964. L.B.C. 10:910. B.R. 33. G.C. III. 55:335.

terminalis, Sieb. & Zucc. Smaller: lvs. obovate-cuneate: the small spikes of whitish fls. terminal. May. Japan. Var. *variegata*, Hort., with white variegated lvs., is in the trade.

P. coriacea, Hook.—*Sarcococca pruniformis*, Lindl.

J. B. S. NORTON.

PACHÝSTIMA: *Pachistima*.

PACHÝSTOMA (Greek, meaning *thick mouth*, referring to the thick lip). *Orchidaceæ*. Terrestrial orchids with leafless scapes from underground nodose rhizomes: pseudobulbs producing 1-2 lvs.: sepals and petals similar, the lateral sepals occasionally forming a chin, all upright; labellum 3-lobed, forming a sack with the base of the column; anthers bent over; pollinia 8, lying in pairs and bound into 4 by elastic threads. About 10 species, chiefly E. Indian and Malayan, but 1 from Trop. Afr. *P. Thomsoniana*, Reichb. f. (*Ancistrochilus Thomsonianus*, Rolfe), is the most commonly cult. species. It has large fls. with white sepals and petals, and the lip has green erect side lobes thickly dark purple-spotted and a narrow recurved midlobe which is white nearly covered with deep purple lines. Trop. Afr. B.M. 6471. J.H. III. 51:147. G.C. II. 12:582 (note), 624, 625; 18:501. Gt. 30:1061.—A warmhouse plant. *P. Thomsoniana* is now referred to *Ancistrochilus* by Rolfe. *Ancistrochilus* has 2 species and is readily distinguished from *Pachystoma* by the pollinia being united to a single stipitate appendage as well as by the remarkable lip and spreading segms.

PACHYSTRÔMA (Greek for *thick layer*). *Euphorbiaceæ*. The one species, *P. ilicifolia*, Muell. Arg., is a shrub or tree of S. Brazil rarely cult. and chiefly in botanical gardens; the oily seed has been used in medicine. Juice milky: lvs. simple, pinnately veined, spinulose dentate: fls. apetalous; sepals valvate or slightly imbricate; stamens 3; styles 3, undivided; ovules 1 in each cell of the ovary. Related to *Manihot*.

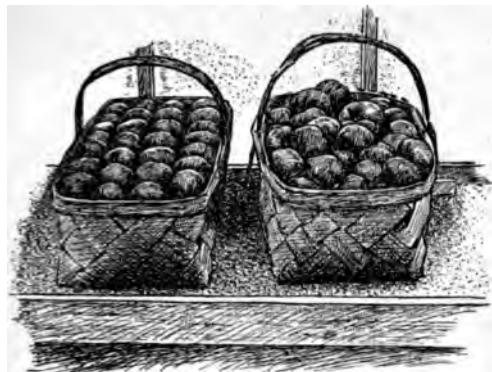
J. B. S. NORTON.

PACKAGES for horticultural produce. The choice of a package and the method of packing horticultural products are very important considerations to every grower who is interested in establishing a reputation for his goods. The commercial value of well-grown produce of choice varieties may be greatly lessened or utterly destroyed if the attempt is made to market it in poor uninviting packages, or if it is poorly packed. Inferior produce or poor varieties are sometimes sold for prices above their real value when packed in an extra attractive way.



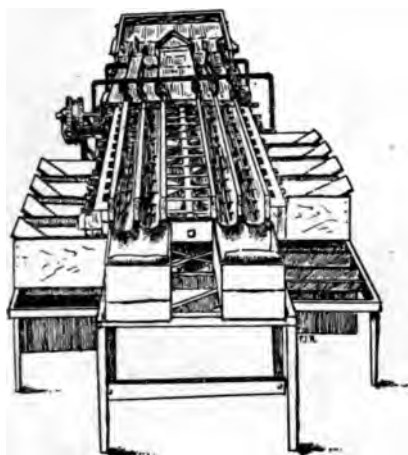
2698. A good pack of apples in a box-tray.

The choice of a marketing package for horticultural products is based largely on customs. These customs have developed gradually along with the growth of the industry in any special region, and when suitable and valuable they persist and become firmly fixed for the



2699. Well-packed and not packed dessert apples.

crop in that section. However, the supply of the raw material and the possibility of securing large quantities of it at a low price are important considerations besides custom. Examples of the custom of adopting a special package in a certain region might be cited, as barrels for apples in the eastern states, boxes in the western states. Peaches are generally packed in flat boxes in the western orchards, and each fruit is wrapped in paper; the same varieties of peaches are marketed from the southern states in six-basket carriers and the fruits are not wrapped, while from Michigan the same variety may be shipped in bushel baskets and from New York orchards in the Delaware type of basket. In general, it would not be advisable to pack any crop in a way that would widely violate the general



2700. Sizing machine.

custom of the community, unless the grower has a special market to receive his produce prepared in his special way.

The illustrations accompanying this article (Figs. 2698-2718) show some of the diverse forms of packages for fruits and vegetables now in use in North America. The methods of packing cut-flowers are discussed in the article devoted to that subject, pages 922-925, Volume II. The separate fruits may also be consulted under their alphabetic entries.

Apples (Figs. 2698-2704, to show the classes only).

Since the beginnings of commercial apple orcharding, the barrel has been regarded as the standard package for the holding and shipping of apples. The size used has varied at different times and in different sections.

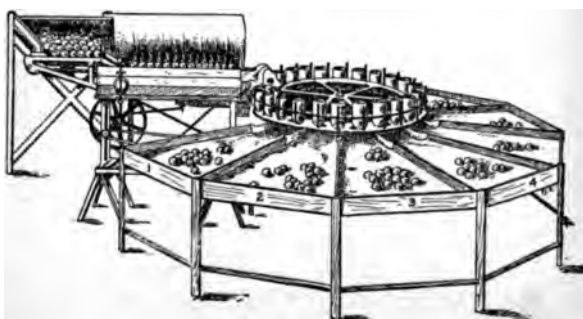
The size now specified by the United States Government as standard for apples is, when measured without distention of its parts: Length of stave, 28½ inches; diameter of head, 17½ inches; distance between heads, 26 inches; circumference of bulge, 64 inches outside measurement; representing as nearly as possible 7,056 cubic inches. Barrels for apples have been in favor for many years, and promise to remain so, for the reason that they are cheap, easily secured in most regions, can be readily handled and easily and quickly packed, and the trade has become thoroughly accustomed to them.

The bushel box has been the standard package for apples in the western United States since apple-production has been of commercial importance in those regions. The box is occasionally used by growers in the eastern apple regions. Formerly its use was always associated with fancy grade high-quality fruit. Western fruits shipped to eastern markets were of this class and always came in boxes. Some eastern growers thought that if even ordinary grades and quality of fruit were packed in bushel boxes, the attractive prices that were secured for western fruit could be secured upon the reputation of the package. The delusion was not long-lived.

As compared with the barrel, the box is a more attractive package, more easily handled, shipped and stored. It is easier to sell from in a store or on a fruit-stand, and when the apples are closely sized, the exact number in every package is known, and they are of



2701. Machine for sizing fruit.



2702. A sizer.

uniform size, and this is of value to dealers and restaurant-keepers.

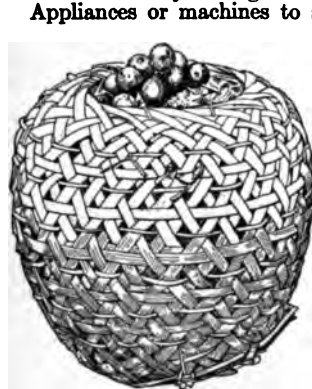
Boxes cost about one-third as much as barrels, and they hold about one-third as much, but more time is required properly to pack three boxes with apples than to pack one barrel properly. The Government stand-



2703. Another form of sizer.

ard bushel box for apples is 18 by 11½ by 10½ inches, inside measurement. There are various styles, those used in the western states being made with solid ends, and two pieces each for the top and bottom, and one piece for the sides. In the East, where the box is used, panel ends instead of solid pieces are used; otherwise the same as the western style.

Apples are usually packed into barrels in the orchard, but sometimes may be carried to a packing-house or shed. A common way is to empty them from the picking-bag or -basket upon a packing- or sorting-table. From this pile, the "facers" are selected. These are fruits of a uniform size and should be of such a color as will honestly represent the average of the crop. The facers are then laid by hand in the then bottom, but later top, of the barrel. Sometimes two layers are placed in by hand. The barrel is then filled by emptying the apples from a basket that can be lowered into the barrel, or emptied from the apron attached to the lower end of the table. The barrel should be frequently "racked," i. e., given several short, quick, vigorous shakes, to settle the fruit and cause one to roll or slip over the other and thus become firmly lodged. When the barrel is well filled, a layer of apples is placed by hand on top. This operation is known as "tailing," and the cover is pressed into place and held there by driving the hoops down toward the larger part of the barrel, and sometimes by nailing.



2705. Bamboo basket for shipping citrus fruits in the Philippines.



2704. A lined picking-basket, for apples, pears and other tree-fruits.

Appliances or machines to size the fruits are used when apples are packed in bushel boxes, and with the recent enactment of laws in several states requiring that the minimum size of the fruits be marked upon the package this becomes necessary when packed in barrels. This sizing may be done by the eye and hand or with the aid of a sizing-board, but for rapid work a machine is necessary. There are a great many kinds, and new styles are manufactured and

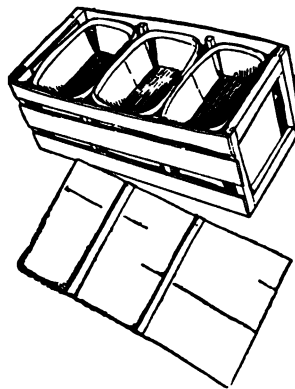
offered for sale every season. (Figs. 2700-2703.) These machines are shown not necessarily for recommendation but to illustrate some of the types.

Grading is the operation of selecting the fruits that are similar in appearance and value. No machine can do this; it must be done by hand. Grades are variable, depending upon the general crop of the season, the ideals of the packer, and the governmental requirements. Usually there is a "Fancy," "Grade A," and "Grade B," or, it is frequently designated as "Fancy," "Standard," and "Choice."

The art of properly packing the graded and sized apples in the bushel box requires skill and practice. There are well-known standardized ways of doing this work. Details of this operation may be found in Cornell Bulletin No. 298.

Apples are also packed in one-bushel hampers, a commonly used package for summer varieties in the Atlantic Coast states, and also in peck and one-half-bushel market baskets (Fig. 2699), and peck crates.

It is always necessary to exercise the greatest care in the picking of the fruit and in handling it from the tree. A good lined picking-basket, with swing handle, is shown in Fig. 2704.



2707. Six-basket crate. Used for tomatoes and peaches in Georgia and Florida.

"lug-" box. It is then hauled to the packing-house, where it is graded by skilled workmen and then carefully sized. The different sizes are packed into standard-size boxes. The orange box, which is made of wood and is 12 by 12 by 26 inches outside measurement, with a partition in the center, may hold from 40 to 400 fruits, but the common sizes are 96, 112, 120, 150, 176, and 200.

Lemons are very carefully graded and sized by hand. A lemon box has outside measurements of 11 by 14½ by 27 inches and holds from 180 to 540 fruits, but the most common and valuable sizes are 300 and 360 fruits.

Pomelos, commonly called grapefruit, are handled in a similar way and packed in the same kind of package as is used for oranges.

In a few cases, half-boxes of all these fruits are packed. All citrus fruits are wrapped in tissue paper.

In Fig. 2705 is shown an interesting native basket or hamper in the Philippines. (Wester.)

Cherries.

Cherries are hand-picked from the tree with



2706. Delaware peach basket.

Citrous fruits.

Citrous fruits are cut from the trees with shears. Care always should be taken to make a smooth close cut, as any injury to the skin or a long stem that may puncture a fruit that it comes in contact with may lead to serious decay. The picked fruit is placed in a bag, or sack, or basket, and, when filled, this is emptied into a "picking-", "field-", or



2708. Berry crate holding thirty-two boxes.

the whole stems adhering to the fruit, or the stems are cut with shears; rarely, when the fruit is to be canned soon after picking, it is pulled from the stem. In this case it is carried to the canning plant in boxes which are lined with newspapers.



2709. Portable hinged crate

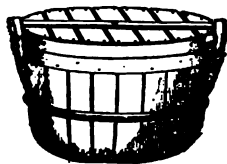
As the fruit is picked, it is placed in baskets or pails and carried to the packing-station, where it is weighed or measured, graded and packed. The packages may be Climax baskets, ten-pound flat boxes, or sixteen-quart crates. The fine varieties of sweet cherries, especially from the western states, are often packed in the ten-pound box. The bottom layer is carefully placed in by hand and enough fruit to make a firm tight pack distributed over the bottom layer, and the cover pressed on.

Grapes.

Grapes are cut from the vines with special grape shears. Fine varieties for fancy market are handled with care, so as not to rub off the bloom. They may be packed in the shipping package in the field, but are usually carried to the packing-house in trays. Some growers prefer to hold them in the packing-house for a day or two, to allow the stems to "wilt," as they can



2710. A vegetable basket.



2711. Bushel basket with cover, useful for vegetables and hard fruits.

then be more easily handled. The packing is usually performed on a table or bench, and from the picking-box or tray into the shipping package.

The most common package is a five-, eight- or ten-pound Climax basket with a solid wooden cover. Grapes intended for wine are marketed in peck or half-bushel baskets, and in New York flat trays are commonly used.

Pears.

Pears were formerly packed in a small barrel or keg holding about five pecks, and more recently pear barrels were commonly used. These held about a peck less than the standard apple barrel. The packages now used are the standard barrel and the bushel box, the same as the apple. When the box is used, each fruit is wrapped in paper.

Pineapples.

Pineapples are packed in crates that hold two dozen fruits, and each one is wrapped in paper.



2712. A bushel box. Useful for fruits and vegetables.

Peaches.

Peaches are picked into baskets of various types, the one-half bushel swing-handle type being the most common, and are carried to the packing-house. In some regions the fruits are run over mechanical sizing ma-

chines, similar to apples, or sized by hand. They may be packed for shipment into flat twenty-pound wooden boxes, and each fruit wrapped in paper. This is the general custom in the western states. In the eastern states the stovepipe or Delaware basket (Fig. 2706), holding sixteen quarts, is used. There may be a slat cover or netting cover, and a light crate that will hold three of these baskets is sometimes used.

The six-basket Georgia carrier is a standard peach package (Fig. 2707). It requires special skill to pack fruit into these baskets properly and rapidly. The half-bushel and bushel baskets are also well recognized peach packages. A round stick placed in the center of the package to support the cover insures a minimum amount of bruised fruit.



2713. Ventilated barrel.

Plums.

Plums are shipped in a great variety of packages. Fancy grades are wrapped in paper and packed in two-quart baskets and four of these are held in a flat wooden box or crate that weighs about twenty pounds. Large fruit varieties are wrapped in paper and packed in flat twenty-pound boxes the same as peaches. Climax baskets, holding from five to twenty pounds are used, also half-bushel and bushel baskets. Small-fruit varieties, like the Dawson, may be shipped in sixteen-quart cases.

Small-fruits (Figs. 2708, 2709).

The berry-like fruits, as blackberry, currant, dewberry, gooseberry, loganberry, raspberry, and strawberry, are almost universally packed in the sixteen-quart crate. In the past, these fruits, especially the strawberry, have been marketed in a great variety of packages, but in recent years the sixteen-quart crate



2714. A good commercial method of packing cauliflowers for special trade.

has rapidly become the standard and widely recognized package.

This package is also commonly used for the small-fruit plums, especially Damsons, and for cherries, both sweet and sour.

The quart boxes are often taken into the field and "picked into," and then carried to the packing-station and placed in the case; or the fruit pickers use a special picking-basket or -box, and this is delivered to the packing-station and the quart boxes filled there, where

the fruit may be graded and the work of the pickers examined.

Cranberries are picked from the vines by special machines or by hand, and packed in barrels. Occasionally twenty-pound wooden cases are used.

Vegetables (Figs. 2710-2718).

Packages used for the shipment of vegetables are not so evenly standardized as those used for fruits. Custom, however, seems to be of about the same importance, for similar vegetables grown in different regions are packed in different ways.

Asparagus is cut and tied in bunches of various sizes. In a few sections the loose stalks are packed in small boxes or crates, but the usual form is a "bunch," and these bunches are packed in any handy-sized box.

Hamper baskets holding from twenty-eight quarts to one and one-fourth bushels are commonly used for packing beans, corn, cucumbers, lettuce, peas, radishes, spinach, sweet potatoes; but a variety of packages is used for some of these products and for most of them ventilated barrels are used.

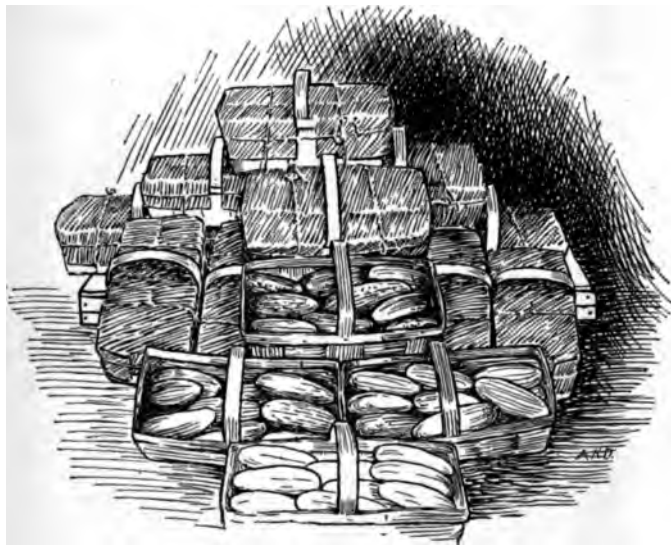
Beets are packed in crates, the same as cabbage.

Brussels sprouts are shipped in quart boxes like small-fruits, and these are placed in cases holding thirty-two, forty-eight or sixty quarts, the forty-eight-quart size being the most common.

Field-grown cauliflower is packed in ventilated barrels; the greenhouse product is packed in small flat boxes or trays that will hold six heads (Fig. 2714).

Packages for shipping celery are of many kinds. Each producing district has its own packages. A common one is a slat crate that varies from 6 by 8 by 24 inches to 10 by 26 by 24 inches. The plants, after being trimmed, are packed upright in these crates, which may or may not be lined with paper. With a fancy product, each bunch is wrapped in paper. A tight flat box, holding twenty-four or more bunches, is frequently used for express shipments.

Cucumbers are packed in baskets (Fig. 2715), hampers, flat boxes, and barrels. Lettuce is packed in barrels,



2715. Basket-packed cucumbers, for a home trade.

hampers, and frequently in crates 16 inches wide, 23 inches long and 8½ inches deep. Such a case will hold two dozen heads of No. 1 or two and one-half dozen heads of No. 2.

Muskmelons are packed in Climax baskets, flat boxes (Fig. 2716), and crates. Sometimes each melon

is wrapped in paper. Special retail packages for celery and sweet corn are shown in Figs. 2717 and 2718.

Onions are shipped in bags holding two bushels, in slat crates holding one bushel, in half-barrel hampers, and various other types of packages, and also in bulk.



2716. A twelve-melon package, used for the small dessert varieties.

Potatoes are commonly shipped loose in a box-car. In cold weather, the car must be lined with paper and a heater in each car keeps them warm enough to prevent freezing. In some sections, the practice is to use bags holding about two bushels. Barrels are frequently used. Ventilated barrels are commonly used for sweet potatoes. Special baking potatoes from some regions are wrapped in paper and packed in bushel boxes. Squash is usually packed in ventilated barrels. Sweet potatoes from New Jersey are packed in hamper baskets; those grown in Virginia, in barrels.

Tomatoes are packed in flat boxes, Climax baskets, six-basket Georgia peach-carriers, and hamper baskets. They may or may not be wrapped in paper. For local markets, a great assortment of packages are used, but the peck and half-bushel market basket is the most common.

H. J. EUSTACE.

PÆDERIA (Latin, *pædor*, bad smell, referring to *P. fetida*). *Rubiaceæ*. Tropical shrubby twiners.

Slender twining plants, fetid when bruised, with terete flexuous branches: lvs. oppsite, rarely in whorls of 3, petioled: fls. small, mostly reddish or whitish, in axillary and terminal dichotomous or trichotomously branching paniced cymes, with or without bractlets; corolla tubular or funnel-shaped; throat glabrous or villous; lobes 4-5, valvate, with crisped margins, often 3-lobed at apex: fr. a small berry. Distinguished from allied genera by the 2-locular ovary and 2 capillary twisted stigmas.—Species about 25, India, Burma, Malay Archipelago, China, Madagascar, Mex. to Brazil. They are little known in cult., the following being a warmhouse climber. It is sometimes known as Chinese fever-plant.

fétida, Linn. Glabrous or nearly so: lvs. long-petioled, ovate or lanceolate, base acute, rounded or cordate: fls. pink, the cyme branches opposite: fr. broadly elliptic, much compressed: pyrenes black, with a broad pale wing, separating from a filiform carpophore. India, Malaya.—Oliver writes that it is





LXXXII. Peony, Baroness Schroeder.

"usually grown as a stove and greenhouse climber, but it is harder than is generally supposed. It is rather an attractive-looking but not free-blooming vine. The leaves, or any part of the plant, when bruised emit a most offensive odor. Cuttings should be put in any time after the growths are matured."

P. Wilsonii, Hesse. A strong climber from China, with hairy branches: lvs. long-petiolate, ovate-lanceolate, to 6 in. long: fls. cream-white with a purple-red eye, less than $\frac{1}{2}$ in. across, in a cluster somewhat like that of the lilac: corolla-tube $\frac{1}{2}$ in. long. This species stood two winters at the Arnold Arboretum, Boston, and blossomed, but was finally winter-killed.

L. H. B.



2717. Basket-packed celery, for home trade.

PÆDERÏTA (from *pæderos*, a name applied by the ancients to a species of *Acanthus*). *Scrophulariaceæ*. Hardy perennial herbs suitable for garden use: low, many-stemmed, puberulent or pilose, with opposite serrate or cut lvs. and dense terminal spikes: fls. short-pedicelled, solitary in the axils of small bracts; calyx 5-parted, the segms. narrow; corolla with a cylindrical tube and a sub-2-lobed limb, the lobes erect or erect-spreading; stamens 2, affixed to the tube: caps. acute, turgid. About 5 species, Eu. and the Orient in the mountains. By some considered a section of *Veronica*. The following species, which though perennial are usually treated as annuals, require a dry situation and light sandy soil. Prop. by seed. *P. Agèria*, Linn. Plant puberulous, 6-12 in. high: lvs. all acute, the lower ovate, middle ones $1\frac{1}{2}$ in. long, almost 1 in. broad, the upper longer and narrower-lanceolate, cut-serrate: fls. yellow, in short compact spikes; corolla nearly $\frac{1}{2}$ in. long with erect segms. May. Eu. *P. Bonardà*, Linn. Plant pilose, 4-6 in. high: lower lvs. orbiculate; upper lvs. ovate or lanceolate, serrate or cut: fls. blue, in compact globose or oblong spikes which are $1-1\frac{1}{2}$ in. long; corolla $\frac{1}{2}$ in. long with somewhat spreading segms. May. Eu.

PÆONIA (after the mythical physician Paeon). *Ranunculacææ*. **PÆONY**. **PINEY**. **PÆONY**. Specially attractive and important flower-garden perennials, prized for the showy spring and early summer bloom.

Herbaceous or woody: roots thickened to form upright rootstocks: lvs. large, alternate, pinnately compound or dissected, mostly ternate: fls. terminal and mostly solitary, but sometimes several, a very few species yellow, but mostly red, purple or white; sepals 5, persistent; petals conspicuous, broad, 5-10, but doubling may take place in any species; stamens numerous: carpels 2-5 on a fleshy disk, becoming dehiscent; follicles bearing the indurated more or less conspicuous style; seeds large, fleshy.—Species about 25, Eu. and Asia, and one small-fl. species (*P. Brownii*) in Calif. and northward. Peonies are among the dozen commonest and best hardy herbaceous perennials. By variation and hybridization, the garden forms are now very many. A botanical monograph by E. Huth, is in

Engler's *Jahrbücher*, Vol. 14 (1891). An account by Baker, from which much of the recent botanical characterization is drawn, appears in G.C. II. 21, pp. 732, 779, 828, and Vol. 22, p. 9 (1884). See also R. Lynch, *Journ. Roy. Hort. Soc.* 12:428 (1890). According to Peter Barr, every species mentioned in *Index Kewensis* had been intro. to cult. in Eu. except *P. obovata*, a native of Manchuria; this species, once intro. but long ago lost, has very recently been brought again into horticultural notice.

It is customary to divide the genus into two groups, one including the herbaceous species and the other (chiefly *P. suffruticosa* or *P. Moutan*) comprising the woody kinds. This division is not invariable as the plants grow under cultivation, and to the horticulturist who wishes to distinguish the stem-species it is confusing. It may be better from the modern gardener's point of view to make the primary divisions on color of the flowers, into the red-white species and the yellow species. The yellow-flowered species have played a small part in the evolution of the cultivated forms, although *P. lutea* is now beginning to contribute a strain, and other yellow species are very promising. The species are difficult to distinguish, even in unmodified forms, and the garden forms are very puzzling to a systematic botanist. The confusion is increased by the use of Latin names for many of the garden varieties. No two systematists could be expected to agree on the limits and nomenclature of species. The following descriptive account is a compromise arrangement of the species.

As with most important genera of a considerable number of members, only a few species are in general cultivation and the others are known mostly only to amateurs and collectors. From the cultural point of view, there are two groups of peonies,—the shrubby or "tree" peonies, and the herbaceous peonies. The former are the product of *P. suffruticosa*, although the woody section has been extended lately by the addition of *P. Delavayi* and *P. lutea*. The Moutans are low shrubs, branching near the ground and bearing many large flowers in shades of red and running to white and even yellowish. This group is now much eclipsed by the popularity of the herbaceous kinds, which bloom



2718. Paper packages or cartons for sweet corn, and other vegetables supplied direct to consumer.

each year on shoots that arise from the crown, the plant dying completely to the ground on the approach of winter. These garden forms are probably the issue of different species, as *P. officinalis* of Europe and *P. albiflora* of Siberia and the far East. The set derived most directly from the former species are mostly earlier-flowering than those from *P. albiflora*. The botanical parentage of the horticultural herbaceous peonies needs

to be worked out from living material combined with a study of the historical development. It is commonly understood, however, that the present race of herbaceous peonies is mostly the progeny of *P. albiflora*, but many are from *P. officinalis*. The importance of the shrubby or tree peonies is not now great, at least not in this country.



2719. One of the modern type of herbaceous peony.

The varieties of this species were once commonly propagated by grafting them on the fleshy roots of the herbaceous species. Non-blooming shoots are chosen as cions, and the union is made in late summer, the tuber and its cion then being handled through the winter in a frame, to be ready for planting out in the spring. A yellow-flowered shrub-peony is lately offered by Lemoine (La Lorraine) as a cross between *P. lutea* and *P. suffruticosa*. This bloomed first in 1904; it was awarded a prize in Paris in 1909. The flowers are soft sulfur-yellow with a salmon tinge when opening, becoming lighter when fully open.

The herbaceous peony has come into great prominence in recent years. In this country, the merits of the plant have been recognized by the organization, in 1903, of the American Peony Society. This Society has now begun the publication of bulletins. It early undertook the study of varieties in a systematic way, coöperating in an extensive test at Cornell University, Ithaca, New York. The test-grounds and the studies corollary to the work, under the leadership of the late Professor John Craig, have yielded four publications: "Peony Check-List," by Coit, 1907; "The Peony," by Coit, Bulletin No. 259, Cornell Agricultural Experiment Station, 1908, in which is given an historical account of the peony, description of the species, and bibliography, as well as cultural advice; "Classification of the Peony" [varieties], by Batchelor, Bulletins Nos. 278 and 306, 1910 and 1911. The reasons for the popularity of the modern race of herbaceous peonies is given by Coit to be the ease with which they are grown, hardiness, permanence in the garden when once established, large size and wide range in color and form of the very showy flowers, fragrance of many of the varieties, freedom from disease and insects, usefulness both for cut-flowers and for landscape effects. As to season of the stem-types, he writes that it is begun, at Ithaca, "about the middle of May by *P. tenuifolia*, and carried along by the well-known old double red peony (*P. officinalis* var. *rubra*). Then come the tree peonies (*P. Moutan* [*P. suffruticosa*]) and, before they are gone, the earlier varieties of the Chinese peonies (*P. albiflora*). Somewhere near July 14, the blooming season closes with the latest varieties of the albiflora group."

The garden herbaceous peonies. (Wm. A. Peterson.)

Herbaceous peonies (Figs. 2719-2722) are among the most hardy, showy, and easily grown of all garden flowers. They stand the severe cold as far north as Duluth without any ground covering. In the southern states their growing season is so extended that they do not develop as fine blooms.

In delicacy of tint and fragrance, the peony more nearly approaches the rose than any other flower. The

old-fashioned early red "piny," cultivated since the time of Pliny, is still a favorite in our gardens. Nearly all of the many hundred named varieties grown at present have been obtained by crossing the various forms of *P. albiflora*. Of the great host of double varieties, nearly all have been developed since 1850. The single-flowering sorts are not so popular as the doubles. They do not seem to keep so long when cut, and fade more rapidly when on the plant.

Propagation of herbaceous peonies.

The easiest and most satisfactory method of propagation is by division of the large, thick roots. The roots may be lifted and divided any time from the middle of August until the stalks appear again in the spring. The best time, however, is in early autumn, when the cut surfaces soon callus over and new rootlets form before the frost sets in. Choose a large stool, cut off the leaves and separate into as many divisions as can be made with an eye to each tuber. In digging, care should be taken that all of the tubers are dug up, for if not they may remain dormant a season and then produce a shoot, giving rise to the many stray plants frequently found in old beds. Tubers divided without an eye should also be planted, as they often act in a similar way and make a showing above ground in two years' time. Peonies, like most tuberous plants, when dormant stand considerable exposure and can be shipped long distances with safety.

Grafting is resorted to in herbaceous peonies when new and rare varieties are to be rapidly increased. An eye of the desired sort is inserted into the tuber of some strong-growing variety, from which all the previous eyes have been removed. This operation is usually performed in August. The grafted plants should be placed in frames for the winter and transplanted the next year into nursery rows.

Propagating by seed is somewhat tedious, and is employed only for increasing distinct species and for obtaining new varieties. The seeds should be gathered as soon as ripe and kept damp until sown in November. A mulch the first season will keep the ground moist and prevent weeds from growing. Usually two years are required for the seed to germinate and three more before a well-developed bloom can be expected.

Soils and culture.

Peonies grow in all kinds of soil, but do best in a deep, rich, rather moist loam. A clay subsoil, if well drained, is very beneficial when blooms are desired, but the tubers ramify more in lighter soil if grown for propagating purposes.

In preparing the bed, trench the soil thoroughly 2 or more feet deep, working in a great quantity of well-rooted cow-manure, as the plants are gross feeders. The ground should be kept well tilled, and an annual top-dressing put above the plants in November; this should be forked into the earth the next spring. They should have a liberal supply of water at all times, and especially while in bloom. Liquid manure, when applied in the growing season and at a time when the ground is dry, gives good returns, both in the growth of the plant and size of the bloom.

The eyes should be set 2 inches below the surface. In transplanting, it is a good plan to remove all the old



2720. A modern herbaceous peony of good habit.

earth so as to start with fresh unimpovertished soil next to the roots. The flowers produced on small divided plants are likely to be imperfect, but when thoroughly established a plant will continue to bloom if undisturbed for upward of twenty years. During the period of blooming an inconspicuous wire support is desirable, as a heavy rain often beats down the flowers.

The host of ancient and modern varieties available, ranging from purest white to deepest crimson, in such a diversity of form and size, afford great opportunity for the making of extensive color schemes. Peonies do fairly well in partial shade, which prolongs and intensifies the color of the bloom, and therefore may be used to advantage to brighten up somber nooks. The period of blooming for herbaceous peonies ranges from the middle of May through June. They grow 1 to 4 feet high and are therefore suitable for planting in front of shrubbery, along driveways, and are especially pleasing when entering into a distant vista. The richly colored shoots, which find their way up through the soil in the early spring, have considerable value for striking effect. When planted in a border with fall-blooming perennials, such as phlox and funkia, their rich glossy foliage is very effective. The old flowers should be cut off, so that no unnecessary seed follicles will be formed, and thereby exhaust the plant. It is important to remove the faded foliage on all peonies in November so that it may not interfere with the next year's shoots.

Because peony buds admit of being shipped long distances without water, and arrive in good condition, they are now used very extensively on Decoration Day and for June weddings. When cut in tight buds and closely wrapped in paraffin paper, some varieties can be held in cold storage for over a month and then open up very satisfactorily.

For forcing, lift the plants in September and place in a coldframe where they will be accessible when the time for forcing arrives. When brought under glass, a uniform temperature of 55° to 60° should be maintained. By feeding well with liquid manure, strong blooms can be produced in eight weeks. A two years' rest is necessary before the plants are forced again. To secure extra-fine blooms on double-flowering varieties, remove the lateral buds as soon as formed. When the first lateral bud is retained instead of the terminal one, a later period of blooming is secured.

Diseases. (A. C. Beal.)

Among the peony diseases, the most prevalent and destructive is the botrytis blight, which attacks the stems, buds, and leaves. Early in the spring the young stems are attacked at the surface of the ground. The tissue turns black, and later the stems wilt and fall over. Sometimes this trouble is seen as late as the following season. The use of green manure appears to favor the attacks of the disease, and only well-rotted manure or mineral fertilizers should be employed. Later, the young flower-buds are attacked, and these turn black and dry up. This is the so-called "bud-blast." When the buds are not attacked until they are well developed, they turn brown and fail to open. The petals are then found to be a dark brown rotten mass, and this is known as the "bud-rot." In very wet seasons, as high as 80 to 90 per cent of the buds may be thus affected. Even the flowers may be discolored by spots resulting from this fungus. The leaves are usually the last to be attacked, and the symptoms are large irregular spots which become brown and dry.

While control methods have not been devised against this and other peony diseases, it is probable that sanitary measures will prove to be most practicable. The prompt and thorough removal of the wilted stems and rotted buds, together with the complete destruction by fire of all leaves and stems in the fall, will tend to lessen the extent of diseases the following year. For an

account of peony diseases by a specialist, see Whetsel, "American Florist," April 10, 1915.

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A. Fls. yellow or orange.

1. *lutea*, Franch. (*P. Delavayi* var. *lutea*, Finet & Gagnep.). St. woody, short, the plant glabrous: lvs. ternately parted, coriaceous, strongly nerved, glaucous beneath, the segms. obovate-oblong and cut or more



2721. Single peony. (× ¼)

or less lobed above the middle: fls. 2-4 in. across, terminal, golden yellow; outer sepals leaflike and long, the inner ones orbicular and yellowish green; petals 6-10, orbicular, concave, the outer ones irregularly crenate; filaments short, the golden yellow anthers long-linear: carpels 3, turgid, glabrous, the style short and recurved. China. B.M. 7788. Gn. 61, p. 267 (note); 76, p. 416. F.S.R. 1:230. R.H. 1906:14.

Var. *supérba*, Lemoine. Seedling from *P. lutea*, with larger fls. (3-4 in. across) and with carmine base to petals when the plant attains age: lvs. bronze-red during development, but becoming deep green. G.C. III. 44: suppl. July 18 (1908).

2. *Mlokosewitschii*, Lomak. Herbaceous perennial, the sts. stout and glabrous: lvs. 2-ternate, the lfts. or segms. broad-oblong or nearly elliptic, short-pointed or acuminate, 3-4 in. long, dark bluish green above and short-pubescent, pale glaucous beneath, the nerves and margins red: fls. 4-5 in. across, yellow, on glabrous reddish pedicels 4 in. long; sepals unlike, one of them oblong-lanceolate and constricted above the base and the other nearly orbicular; petals about 8, roundish,

concave; stamens very numerous, the filaments twice as long as anthers: carpels 3, oblong, whitish tomentose, the stigmas sessile and purple. Caucasus; discovered by Mlokosewitsch and only recently intro.; said to be the most handsome of the yellow-fl. species. B.M. 8173. G.C. III. 44, suppl. July 25 (1908). R.H. 1911, pp. 432, 433.

3. *Wittmanniana*, Stev. Herbaceous perennial, 2-3 ft., green, glabrous and smooth: lvs. 4-8 in. long, 2-ternate; lfts. variable, usually ovate to ovate-cordate and the lateral ones often oblique at base, glabrous above, rather glaucous and lax-hairy beneath: fls. 4 in. across, solitary, pale or whitish, yellow or greenish; sepals irregular, green, concave; petals about 7, broad-elliptic-obovate, membranaceous, concave; stamens with orange-yellow anthers and slender red filaments: carpels 2 or 3, oblong-ovoid, glabrous, the stigmas recurved. Caucasus region. B.M. 6645. B.R. 32:9. R.H. 1906, pp. 348, 349. G. 27:135.—The first intro. of the yellow peonies, although not strongly yellow; intro. to gardens of



2722. *Paeonia albiflora*.

Royal Hort. Society (England) in 1842. Light and not pronounced in color, and apparently not of great promise.

AA. Fls. white, in shades of red or purple (exceptions sometimes in No. 11).

B. Petals scarcely longer than the sepals.

4. *Bröwnii*, Douglas (*P. californica*, Torr. & Gray). Low and somewhat fleshy, about 1 ft.: lvs. glaucous or pale, lobes obovate to nearly linear: fls. dull brownish red; petals 5 or 6, thickish, little if any longer than the concave sepals; outer sepals often leaflike and compound; fl.-sts. reclining or recurved; disk many-lobed: follicles 4-5, nearly straight, glabrous, the fr. finally resting on the ground from the bending over of the st.; seeds oblong. Early spring or summer. Calif. to Wash. and northward, and in Nev. and Utah. B.R. 25:30.

BB. Petals much exceeding the sepals.

C. Disk expanded and involving or enveloping the carpels: plants woody.

5. *suffruticosa*, Andr. (*P. Moutan*, Sims. *P. arborea*, Donn). TREE PÆONY. St. 3-6 ft. or even higher much branched, distinctly shrubby: lvs. glabrous; lfts. more often entire at the base of the plant than above: fls.

large, various in color, as rose, red, to white: follicles numerous, very hairy, rather small. May, June. N. W. China.—Long cult. in the Orient, where varieties are numbered by the hundreds. The following varietal names have been transferred from combination with *P. Moutan*, now making new combinations: Var. *rûbro-plena*, Bailey. Rose-colored, almost single. Var. *rôseo-supërba*, Bailey. Fls. much more doubled. Gn. 31:76 (as Reine Elizabeth). F.S. 14:1395, 1396 (as Triomphe de Grand). Var. *vittata*, Bailey. Fls. single white, rose and flesh-color, striped, fragrant. F.S. 7:747. Var. *papa-veràcea*, Bailey. Petals thin and poppy-like, white, with red at center of fl. B.M. 2175. L.B.C. 6:547. Gn. 38:370; 52:325, and pp. 324, 325. Var. *Banksii*, Bailey. Fls. much doubled, rose-colored, and large. B.M. 1154. Var. *Hûmei*, Bailey. Fls. semi-double, whitish or bluish with darker center. B.R. 379. Var. *rôsea*, Bailey. Fls. bright rose-colored, fragrant, more or less double. L.B.C. 11:1035.

6. *Delavayi*, Franch. Woody or subshrubby, branching, glabrous, 3 ft., more or less stoloniferous: lvs. ternate, somewhat glaucous beneath, 1 ft. long; segms. lanceolate or ovate-lanceolate, 2-4 in. long, cuneate, decurrent and confluent at base: fls. small (about 2 in. across), dark purple or velvety crimson; petals suborbicular, 5-9, remarkable for their firm substance; stamens yellow: carpels 5, glabrous, spreading. July. China, at high altitudes. Var. *angustiflora*, Rehd. & Wils., has more finely divided lvs., the lfts. being narrow-lanceolate. G.C. III. 53:403 (as *P. Delavayi*).—In Ireland *P. Delavayi* is said to be cut to the ground sometimes by the winter but it throws up new shoots in spring. Somewhat like *P. lutea* except in color of fls.

CC. Disk little if at all expanded and not enveloping base of carpels: plants herbaceous.

D. Blooms several on one st.

7. *Veitchii*, Lynch. Herbaceous, 2 ft., with 6 or 7 lvs. on st.: lvs. shining, light green, with many (about 15) very acute lance-oblong segms. which are about 1/2 in. broad; petiole of lowest lf. about 4-8 in. long: fls. several on the st. rather than solitary, nearly 4 in. across, often nodding and sometimes becoming flat, purplish crimson. W. China. G.C. III. 46:2. Gn. 73, p. 539. R.H. 1914, pp. 196, 197.—A recently described species; a compact, attractive plant.

DD. Blooms mostly solitary or single on each st. (partial exception in No. 8 and others under cult.).

E. Lfts. all entire, sometimes confluent at base.

8. *albiflora*, Pallas (*P. edulis*, Salisb.). Fig. 2722. Root of fusiform parts or tubers: st. 2-3 ft., often branching and bearing from 2-5 fls.: lower lvs. biterminate; parts petiolulate or the lateral ones sessile, the lfts. (secondary lfts.) 3-4 in. long, oblong, lanceolate or elliptic, veining red: peduncle long, often with a large entire or lobed bract; outer sepals large, leaflike; petals large, various in color, usually white or pink, 8 or more; stamens golden yellow: follicles 3-5, ovoid, recurved-spreading, with spiral or reflexed stigmas. June. Siberia, China, Japan. B.M. 1756. F.S. 8:812. Gn. 30:588 (var. *Adrian*); 50, p. 170; 51:448. J.H. III. 58:493. Gt. 7:362 (forms). A.G. 23:643; 25:203.

Var. *Reevesiana*, Loud. (*P. Reevesii*, Hort.). A double form, with deep red petals. P.M. 1:197.

Var. *sinensis*, Steud. (*P. chinensis*, Vilm.). A tall Chinese variety, with large, double, crimson fls. One of the commonest forms in gardens. B.M. 1768.

Var. *festiva*, Planch. Fls. double, white, with a few marks of carmine in the center. F.S. 8:790-91.

Var. *Whitleyi*, Hort. (not var. *Whitleyi*, Anders., which has double pinkish fls.). Fls. single, large, white. Gn. 36:8; 63, p. 352.

9. *obovata*, Maxim. (*P. oreogelon*, S. Moore). Root or rhizome of elongated cylindrical tubers: st. 2 ft. high:

lower lvs. twice ternate; lfts. membranaceous, broadly ovate or obovate, more or less pubescent, especially beneath, the central one stalked: fls. not fragrant, 4-5 in. across, white according to G.C. III. 57:290 (usually described as red-purple); petals about 6, obovate, concave, very obtuse; sepals white or pale rose: carpels recurved, the seeds blue-black and berry-like. June. Siberia, N. China, Japan.

10. *coriacea*, Boiss. Allied to *P. albiflora*: glabrous, the st. nearly simple and reddish: lvs. coriaceous, glaucous beneath, the lower ones biternate; lfts. very broad: fls. bright crimson: carpels 2-3, deflexed, glabrous; seeds dark purple. June. Spain, N. Afr.

11. *corallina*, Retz. Tall, from carrot-form roots: lower lvs. biternate or rarely triternate; lfts. ovate or obovate, glabrous, or pubescent beneath: fls. purple or rarely whitish or even yellowish: carpels about 5, spreading or recurved, densely tomentose when young but glabrous at maturity; seeds round, reddish to dark blue and becoming black. April, May. S. Eu.

12. *Cambessedèsii*, Willk. Like *P. corallina*, but that species has glaucous-green never purple lvs. and hairy carpels: herbaceous perennial, about 1½ ft., simple, erect and glabrous: lvs. ternately pinnatisect, with ovate-lanceolate or oblong acute entire glabrous segms. that are deep green above and purple beneath: fls. deep rose-pink, solitary, erect, 3½ in. across, the petals 5-10, broadly obovate and crenulate; stamens many, with purple filaments and yellow anthers: carpels 5-7, erect, glabrous and shining, purple. Balearic Isls., Corsica. B.M. 8161.

EE. Lfts. more or less lobed.

F. Lvs. and st. glabrous throughout.

13. *tenuifolia*, Linn. Fig. 2723. Root or rhizome creeping, tuberous: st. 1-1½ ft. high, 1-fl., densely leafy up to the fl.: lvs. ternate, glabrous, cut into numerous segms. often less than 1 line broad: fl. erect; petals dark crimson, elliptic-cuneate, 1-1½ in. long; anthers shorter than the filaments; stigma red, spirally recurved: follicles 2-3, about ½ in. long. June. Caucasus region. B.M. 926. A.G. 17:658. Var. *fiore-pleno*, Hort. (Fig. 2723). Fls. double, crimson. F.S. 4:308. Var. *hybrida*, Hort. Fls. of a rich crimson color: lvs. very pretty.

14. *anómala*, Linn. Root tuberous: st. 2-3 ft., 1-fl., glabrous: lvs. biternate, glabrous beneath, cut into numerous, confluent lanceolate long-acute segms.: fl. bright crimson, very large; outer sepals often produced into compound leafy points; petals obovate to oblong: follicles 3-5, ovoid, arcuate, tomentose or glabrous. June, July. Eu. and Asia. B.M. 1754. Gn. 67, p. 375.

Var. *insignis*, Lynch. The variety most cult.: st. 1½-2 ft. high: lvs. about 10, the lower ones very large, gradually reducing to the fl.: carpels with red pubescence.

Var. *intermedia*, C. A. Mey. Lvs. deeply lobed: fls. rosy crimson.



2723. *Paeonia tenuifolia*. (×½)

15. *officinalis*, Linn. (*P. fulgida*, Sabine). Fig. 2724. St. stout, 2-3 ft. high, 1-headed: lvs. dark above, pale beneath, the lowest more divided than the others, having 15-20 oblong-lanceolate lfts., 1 in. or more broad: outer sepals leaflike; petals dark crimson, 1½-2 in. broad, obovate; stigmas crimson, recurved: follicles 2-3, becoming 1 in. long. May, June. Eu. One of the old forms in gardens. B.M. 1784. Gn. 53, p. 233.—By some combined with *P. peregrina*.

Var. *álbo-plèna*, Hort. Fls. double, white tinged with red. Gn. 19:14. Garden forms are given trade names, as: *anemonæflora*, crimson, globular fls., with a mass of twisted crimson stamens, edged with yellow. A.G. 17:663. Gn. 31:512; *blánda*, pale pink; *lobáta*, lvs. distinctly lobed: fls. cerise-salmon, a very unusual color. Gn. 79, p. 351; *rosea*, rich deep rose; *Sábini*, rich deep crimson petals and yellow stamens. L.B.C. 11:1075.

Var. *festiva*, Tausch. Fls. white, with red centers. Native of Eu.

FF. Lvs. and st. pubescent, at least in the upper part.

16. *peregrina*, Mill. Sts. about 1½-2 ft. high: lvs. 5-6 on a st., deep green and glabrous above, pale green and pilose beneath; otherwise the lvs. and fls. are much like those of *P. officinalis*. Eu.—Two garden forms with double fls. are: *amaranthescens sphérica*, and *pulcherrima plèna*, the latter differing from the former in the purple shade of crimson fls. This species-name is used by Huth to cover a number of the forms that by others are regarded as tenable species.



2724. *Paeonia officinalis*. (×½)

17. *paradóxa*, G. Anders. Plant one of the dwarfest: lvs. in a dense tuft; lfts. 3-lobed and incised: fls. purple-red: carpels pressed closely together. S. Eu.—Differs from *P. peregrina* by smaller ovate and more glaucous lvs., lfts. more divided and crowded. Var. *fimbriáta*, Hort. Double purple fls., with projecting purple stamens; very pretty, but not much cult. in Amer. The species is sometimes referred to *P. peregrina*.

18. *arietina*, G. Anders. St. 2-3 ft. high, hairy toward the top: lvs. 5-6 on a st., rather glaucous and pubescent beneath; segms. oblong to oblong-lanceolate, strongly confluent, decurrent: fls. always solitary, dark red, large: follicles 3-4, densely tomentose, ovoid, spreading widely, becoming 1 in. long, strongly arched; stigma recurved. S. Eu. B.R. 819 (as *P. cretica*).—There are a number of horticultural varieties, under vernacular names. *Andersonii*, bright rose; *Bázleri*, crimson; *crética*, blush-pink. The species is by some combined with *P. peregrina*.

19. *decóra*, G. Anders. Tubers oblong: sts. 2-3 ft. high: lvs. horizontal, diminishing to the top; lfts. oblong-obtuse: fls. rather small, deep purple; petals few, small, narrow, peduncle long: follicles hairy, large, spreading from the base when mature. S. Eu. Var. *álba*, Hort., has satiny white fls., slightly tinted pink. Gn. 72, p. 291.

Var. *Pállasii*, G. Anders. Lvs. narrow-oblong: fls. rich crimson. G. 29:225.

Var. *elätior*, G. Anders. Lvs. broadly oblong: fls. rich crimson, very large: receptacle with few processes, and a connection between the carpels at their base of similar surface and appearance to that of the carpels.

P. Broteri, Boiss. & Reut. (*P. corallina* var. *Broteri*, Huth). Fls. red, varying to white: carpels densely white-tomentose: allied to *P. officinalis* and *P. corallina* in lvs. and habit.—*P. cœvica*, Sieber. Much like *P. coriacea*.—*P. Emodii*, Wall. Closely related to and sometimes regarded as a synonym of *P. anomala*. B.M. 5719. Gn. 45:70.—*P. humilis*, Retz. (*P. peregrina* var. *humilis*, Huth). Rather low: fls. bright red: carpels glabrous or very nearly so. B.M. 1422.—*P. microcarpa*, Boiss. & Reut. Allied to the preceding and referred to it by Huth, but dwarfier. Var. Jonathan Gibson is a garden form, with very downy lvs.—*P. mollis*, G. Anders. Low, about 1 ft., with 1 fl. to the st.: lvs. dull green above, glaucous and pubescent beneath, with many oblong-lanceolate segms.: fls. deep red and subsessile: carpels 2-3, pilose, erect-curved. A doubtful species allied to *P. anomala*. L.B.C. 13:1263.—*P. pubens*, Sims. Allied to *P. officinalis* probably: lvs. hairy below, margins red.—*P. Russii*, Biv. (*P. corallina* var. *Russii*, Huth). Allied to *P. corallina*, but with the lvs. decidedly hairy below.—*P. sessiliflora*, Sims. Nearly related to *P. mollis*: very low: fls. subsessile, white.—*P. trivernata*, Pallas (*P. corallina* var. *Pallasii*, Huth). Differs from *P. corallina* in its rounded lvs., green st., and rose or whitish fls. B.M. 1441 (*P. daurica*).

K. C. DAVIS.
L. H. B.†

PAINTED CUP: *Castilleja*.

PAINTED LEAF: *Euphorbia heterophylla*.

PALAFÓXIA HOOKERIANA: *Polypoteris*.

PALAQUITUM: *Isonandra*.

PALAÛA (after Anton Palau y Verdera, professor of botany at Madrid the latter half of the eighteenth century). Also written *Palava*, under which name it appears in lists. *Malvaceæ*. Flower-garden herbs.

Annual or perennial, tomentose or somewhat glabrous: lvs. usually lobed, dissected or sinuate: bractlets 0: fls. purple or purplish, axillary, peduncled, solitary; calyx 5-cut; stamens in a column which is much divided at the top; ovary many-celled; style stigmatose at the apex: carpels crowded without order.—Species 9 in 1908, as accepted by Ulbrich in Engler's Jahrb. 42; Peru and Chile.

dissecta, Benth. (*P. flexuosa*, Mast.). Slender annual, branched from roots: sts. 8-12 in. long, ascending, flexuous above: lf.-stalks 1-2 in. long; blades 1-2 in. long and broad, triangular in outline, pinnatifid, the segms. lobed; lobes obtuse: fls. many, well separated from the foliage, about 1 in. across, lilac with whitish center, the stamens rose-purple and arranged in 5 longitudinal series; styles 25-30. Peru. B.M. 5768. H.F. II. 12:43.

L. H. B.

PALÁVA: *Palava*.

PALISÔTA (named in honor of A. M. F. J. Palisot de Beauvois, 1752-1820, French administrator, traveler and botanist). *Commelinaceæ*. Perennial herbs, sometimes grown as pot or tub specimens under glass, as in palm houses, for the foliage.

Stem or caudex either long or very short, simple or nearly so, with the lvs. crowded at the top or base: lvs. long, parallel-veined, hairy when young and the margins with reddish or grayish hairs: fls. mostly white or purplish or rose, in many small cymes which are arranged in a dense or elongated panicle on mostly 1 peduncle that is terminal or essentially so; sepals and petals 3, the latter obovate; stamens 3, perfect, and 2 or 3 bearded staminodes; ovary 3-celled, with 1-several ovules in each: fr. a colored fleshy or succulent indehiscent berry.—Species about 15, in Trop. Afr. Little known in cult. outside of collections. The lvs. are often banded or striped, and the colored hairs make them conspicuous. For cult., see *Commelina*, p. 835.

P. Albertii, Gentil. Sub-caulescent: much like *P. Elisabethæ*, but lvs. not variegated and petioles without marginal hairs, also stronger-growing: lvs. very dark green, grayish hairy beneath, to 3 ft. long and 4-10 in. wide, long-attenuate to petiole, the latter widely channeled. Habitat not given.—*P. Bârtéri*, Hook. f. Sts. 1-5 in. long, with lvs. near the base (i. e., practically radical), the young parts shaggy hairy: lvs. to 2 ft. long by about 4 in. wide, obovate-lanceolate, abruptly contracted into a tip 1 in. long, at

maturity with densely hairy margins but otherwise often nearly glabrous: infl. about 2 in. long (or longer in cult.), very many-fld.: fls. pale purplish. Upper Guinea. B.M. 5318.—*P. bicolor*, Mast., imperfectly known, has oblong-ovate lvs. about 1 ft. long, with a broad band in center of greenish yellow, the margins brown-hairy and fleshy petiole with broad purplish band. Upper Guinea.—*P. Elisabethæ*, Gentil (*P. Pynaertii* var. *Elisabethæ*, Hort.). Cauliscent: lvs. long-acuminate, obovate-lanceolate, marked with greenish yellow variegation along the median line, 2-3 ft. long and 4-10 in. wide, long-attenuate to petiole, the latter thick and several inches long, broadly canaliculate with rufescent hairs on the margin. Habitat not given. G.C. III. 48:423. Gt. 64, p. 49.—*P. Pynaertii*, Wilderm. The plant in cult. seems to be the variegated-lvd. form and which is probably the same as *P. Elisabethæ*, although the latter is said to differ in general form of growth and to have longer lvs. and with widely channeled petiole. Trop. Afr. R.B. 35:376 (as fol. var.).—*P. Schweinfurthii*, Clarke. St. 3-7 in. long and ½ in. diam., with 2 or 3 lvs. at the nodes: lvs. to 2 ft. or somewhat more and 8 in. broad, elliptic, short-acuminate at either end, densely hairy on margin but more or less glabrate otherwise: infl. 4-7 in. long, cylindric and very dense, containing several hundred fls. Trop. Afr., widely spread. G.W. 8, p. 553.—*P. thyrsoiflora*, Benth. Shaggy-hairy on young parts, the sts. to 15 ft. long: lvs. very large, lance-ovate or oblong-elliptic, the margins densely hairy: fls. white, in a loose panicle often 2 in. wide and 10 in. long; ovary glabrous: berry ½ in. or more diam., blue. Upper and Lower Guinea. The *Dichorisandra thysiana*, Hort. (G.C. III. 28:302. R.B. 28:133), is probably this plant. It is described as a "plant of striking habit, and bold ascending foliage:" from Hort. Linden.

L. H. B.

PALIÛRUS (ancient Greek name). *Rhamnaceæ*. Ornamental woody plants sometimes grown for their attractive foliage and curiously shaped fruits.

Trees or shrubs: stipules usually changed into spines: lvs. alternate, 3-nerved, entire or serrate: fls. small, perfect, in axillary or sometimes terminal cymes; petals 5, 2-lobed; stamens 5: fr. woody, 3-celled, depressed subglobose, with a broad orbicular horizontal wing; cells 1-seeded.—Six species from S. Eu. to Tonkin, China, and Japan.

These are spiny trees or shrubs sometimes procumbent with two-ranked generally ovate medium-sized leaves and small greenish yellow flowers in axillary clusters followed by orbicular broadly winged, curiously shaped fruits resembling a head with a broad-brimmed hat. The one species cultivated in this country is not reliably hardy north of Washington, D. C.; in Massachusetts it is killed every winter almost to the ground even with protection, and the young shoots flower but bear no fruit. It is not very ornamental, but the dark green foliage is pretty and the curious fruits are interesting. It thrives in any well-drained soil and prefers a sunny and warm position. Propagation is by seeds stratified or sown in autumn and by layers or root-cuttings.

Spina-Christi, Mill. (*P. australis*, Gaertn. *P. aculeatus*, Lam. *Zizyphus Paliurus*, Willd. *Rhamnus Paliurus*, Linn.). JERUSALEM THORN. CHRIST'S THORN. Spreading, spiny shrub or small tree to 20 ft., sometimes procumbent: branches brown: 1 of the 2 spines at the base of the petioles straight, the other hooked and recurved: lvs. rather slender-petioled, ovate, usually unequal at the rounded base, obtuse, minutely serrulate, glabrous, dark green above, pale or grayish beneath, ¾-1½ in. long: fls. in axillary short-peduncled cymes: fr. brownish yellow, about ¾-1 in. across, glabrous. June, July. S. Eu. to Himalayas and N. China. B.M. 1893; 2535 (as *P. virgatus*). G.C. III. 50:377.—This plant is supposed to have furnished the crown of thorns which was placed on the head of Christ before his crucifixion; others think *Zizyphus Spina-Christi* to be the shrub the crown was made of. These two shrubs resemble each other closely, but the branches are whitish and the frs. berry-like in *Zizyphus*; the shape of the spines is exactly the same in both species.

P. orientalis, Hemsl. Tree, to 30 ft.: sometimes unarmed: lvs. 2-4 in. long, glabrous: fr. 1-1½ in. across, glabrous, purplish. China. This but recently intro. species is perhaps the most ornamental of the genus; it has not proved hardy at the Arnold Arboretum.—*P. ramosissimus*, Poir. (*P. Aubletia*, Remy. & Schult.). Shrub similar to *P. Spina-Christi*, but with both spines straight, with larger lvs. pubescent beneath, and smaller tomentose frs. with narrow wing. China, Japan.

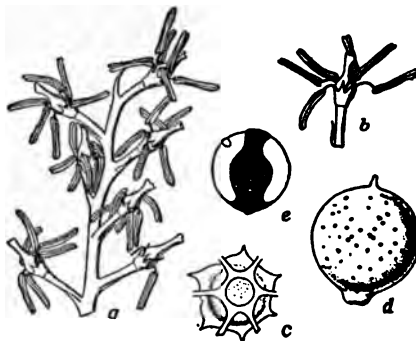
ALFRED REHDER.

PALM. Palms are amongst the most striking plants in tropical floras. The tall mostly straight unbranched trunks surmounted by a spreading canopy of huge pinnate or digitate leaves distinguish them from nearly all other forms of vegetation. They are widely spread in warm regions, being most abundant in America and Asia and few in Africa. They are particularly conspicuous in the Pacific Islands. Although the palms are such bold and interesting plants, the species are imperfectly understood. This is due to the great difficulty of making herbarium specimens, to the fact that the greater number of botanists are residents of regions in which palms do not grow, and to the differences of opinion as to the relative importance of the various botanical characters. Many of the palms have been named first from cultivated specimens, and often before the flowers and fruits are known. When the specimens finally come to fruit, the names are usually shifted, causing much confusion. The proper generic position of a palm may be unknown for several years after it becomes popular in the horticultural trade. Consider the changes in nomenclature which have occurred in palms that have been referred to the genera *Areca* and *Kentia*.

The species of palms are not very numerous as compared with orchids, composites and grasses. They probably do not greatly exceed 1,200, as at present known, although more than that number have been described. Benthams & Hooker accept 132 genera, and Drude, in Engler & Prantl's "Pflanzenfamilien," accept 128 genera. Most of the genera are small, and many of them are monotypic. The largest genera are *Calamus*, with about 200 species, all Old World, mostly Asian; *Geonoma*, with about 100 species, all American; *Bactris*, about 100, American; *Chamaedorea*, with about 60, all American; *Licuala*, with 30, ranging from eastern Asia to Australia; *Desmoncus*, about 25, American; *Cocos*, 30, all confined to America but the coconut, which is now cosmopolitan; *Pinanga*, with about 25 species, of the oriental tropics; *Areca*, nearly two dozen, oriental. Many of the species, particularly in the small genera, are restricted to very small geographical regions, often to one island or to a group of islands. The palms represent an old type of vegetation, and they are now, probably, on the decline, as measured

General characteristics.

The members of this family are essentially tropical in habitat, are highly ornamental in appearance, and many of them also of very great economic value, their fruits, stems and leaves not only entering largely into the manufactured products of both Europe and America



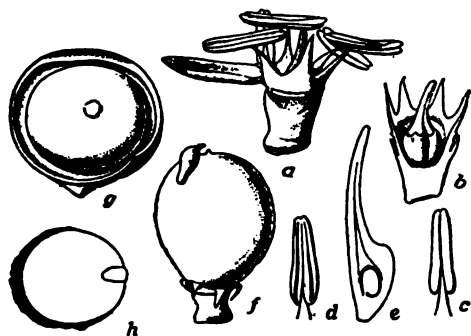
2726. Flowers and fruit of *Thrinax Wendlandiana*.—a, top part of flowering branchlet; b, flower; c, fruiting perianth, seen from above, from which the fruit has been taken; d, fruit; e, longitudinal section of seed, through embryo.

but also providing both food and shelter for thousands of the inhabitants of tropical countries. One notable characteristic of palms in general is their unbranched stems, the exceptions to this rule being very few and mostly limited to the members of one genus, *Hyphæne*, of which the doum palm of Egypt, *H. thebaica*, is the best example. While these unbranched stems form a prominent feature in connection with this order of plants, yet great variations are found in size and habit, some of them towering up like a slender marble shaft to a height of more than 100 feet and then terminating in a crown of magnificent plume-like leaves, while others may reach a height of only 3 to 4 feet when fully developed, and some species are permanently stemless. In some examples the stems are so long and slender that a scandent habit is the result; these rope-like stems of the rattan palms in particular are described as wandering through the tops of some of the great trees of the Malayan Peninsula to a length of several hundred feet,—reported as long as 1,700 feet, but report unreliable.

The foliage of the palms is of two chief kinds, the fan-veined leaves, in which the venation radiates from a common center, and the feather-veined, in which the veins run out from the sides of a long midrib, the leaf being frequently divided into long narrow segments. Of the first group, the common fan palm, *Livistona chinensis*, is a good example, while the date palm, *Phoenix dactylifera*, and also the coconut, *Cocos nucifera*, are common examples of the feather-veined class. There are also minor characteristics of foliage that mark many of the genera, some having pinnate leaves with erose tips, a few having bipinnate leaves (as *Caryota urens*), others with flabellate leaves having erose segments, and many with the segments of the leaves bifid or split at the tips.

The flowers of palms in general are not specially attractive either in size or coloring, many of them being greenish white or yellow, and some orange or red; but these flowers are produced in prodigious quantities by some of the species, perhaps the most prolific in this respect being the talipot palm (*Corypha umbraculifera*), which throws up a branching inflorescence to a height of 30 feet above the foliage, such an inflorescence having been estimated to include fully 60,000,000 flowers! This, of course, applies only to wild specimens.

The seeds of palms are also found in many sizes and various shapes, ranging from the size of a pea in some of the *Thrinax* to the unwieldy fruit of the double coco-

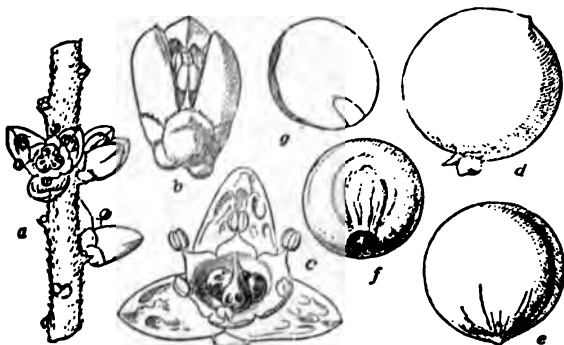


2725. Flower and fruit of *Pritchardia Wrightii*.—a, flower in anthesis, with one segment remaining attached to corolla-tube; b, flower in lengthwise section, segments and anthers wanting; c, anther, dorsal view; d, anther, ventral view; e, lengthwise section of carpel; f, young fruit, with remains of sterile carpel at apex; g, section of kernel, showing entire seed inside; h, section of seed along line of raphe.

in geological epochs.—Perhaps the most complete account of the botany of certain groups of palms is by O. Beccari in such works as: "The species of *Calamus*," "Le Palme Americane della tribu della *Corypheæ*," "Notes on Philippine Palms," and many smaller papers. O. F. Cook has also written extensively of the American species.

nut, *Lodoicea maldivica*, which will sometimes weigh forty pounds each and require several years to reach maturity.

As a rule, the members of any single genus of palms are found in one hemisphere, either the eastern or western as the case may be, probably the greater num-



2727. Flowers and fruits of *Acolorhapha Wrightii*.—a, part of flowering branchlet; b, unopened flower; c, flower full open; d, fruit; e, kernel of fruit; f, seed as shown on the raphe side; g, lengthwise section through embryo.

ber of species being of Asiatic and American origin, rather than African. An apparent exception is found to this system of hemispheric distribution in the case of the coconut, this plant being so very widely distributed throughout the tropical world that its original habitat is still in doubt. On the other hand, some species are known to be very local in their natural state, in proof of which the howeas may be cited; this genus has been found only within the circumscribed area of Lord Howe's Island, which, from a comparative point of view, may be termed merely a fragment of land (probably of volcanic origin), a mere dot on the broad bosom of the South Pacific.

Few palms are found within the limits of the United States as natives, the most common being the well-known palmetto, *Sabal Palmetto*, a member of the fan-leaved section, to which many of the American palms belong. But while the species of palms native in the United States are limited in numbers, yet there is at least one unique species in the group in the form of *Pseudophoenix Sargentii*, a monotypic palm, that is known to exist in a wild state only on certain of the Florida Keys, and in limited numbers even there, and recently in Cuba and Santo Domingo.

Europe is even less favored as to native palms, there being but one species known there in that condition, *Chamærops humilis*, also a fan-leaved species and comparatively hardy, being capable of enduring moderate frosts.

The palm tree of the Bible is doubtless the date palm, *Phoenix dactylifera*, which is found in large numbers throughout Syria to this day; and in fact the small grove of dates within easy reach of the Syrian householder forms one of his most valuable assets, for it provides food not only for his family, but frequently for his horses or camels also.

The act of producing flowers does not necessarily terminate the life of a palm, though in some instances such an effect may be produced by this cause; but a singular habit has been noted in regard to the flowering of the fish-tail palm, *Caryota urens*, which when it reaches maturity begins to throw out a flower-spike from the top of the stem, this being followed by successive spikes of flowers, and ultimate bunches of seeds from the top of the plant downward, the flower-spikes appearing at the joints of the stem, and when this process of flowering has proceeded down to the ground, or

until the vitality of the plant has been exhausted, death ensues.

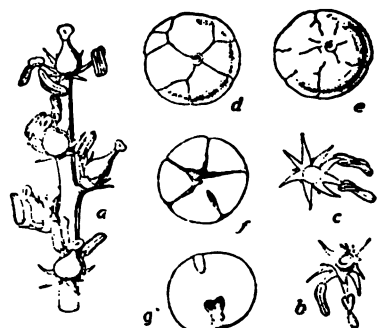
There are also a number of species of palms that develop a soboliferous habit, throwing up a number of shoots from the base of the plant, *Rhapis flabelliformis*, sometimes known as the ground rattan, being a good example of this class, among which the widely grown and elegant *Chrysalidocarpus lutescens* is also found, together with the geonomas, some of the phoenix and various other genera. Many of the palms are unisexual, but there are also many others in which both male and female flowers are produced on the same spadix, in some examples the males being grouped together near the ends of the branches of the inflorescence and the females nearer to the main stem, while in others a female is placed between two males, thus arranging the flowers in threes.

Cross-pollination of palms by artificial means has probably been seldom practised, there being few cultivated collections in which the opportunity for such an operation has presented itself; but it seems highly probable that such cross-fertilization has been accidentally effected among wild plants, for in large lots of seedlings intermediate forms are frequently seen, this peculiarity having been noted among howea seedlings, where forms intermediate between *H. Belmoreana* and *H. Forsteriana* are found, and sometimes seedlings that seem to combine the characteristics of *H. Belmoreana* and those of its near relative *Hedyscepe Canterburyana*. Similar variations from a given type have also been noted among the phoenix, several so-called species being most likely merely varieties.

Many palms are armed with stout thorns or prickles, not only the stems but also the leaves and even the fruits in some species being thus guarded, these prickles being usually very hard and tough. In some cases, notably *Acanthorhiza aculeata*, the prickles around the stem are often branched, and are decidedly unpleasant to come in contact with. In the case of *Desmoncus*, this being the western representative of the rattan palms, the tip of the midrib of the leaf is continued in the form of a hooked spine, and helps to support the plant in its scandent career. The sharp spines of certain palms are used for poisoned arrows by some of the South American tribes, these arrows being projected through a blow-pipe formed from a section of the hollow stem of another palm. Among the species of Phoenix, it is often found that several of the leaflets nearest to the base of the leaf are developed as spines, these thorny leaflets becoming stiff and hard, and capable of making a very sore wound.

The very great economical value of many of the palms can only be touched upon within the limits of the present article, the

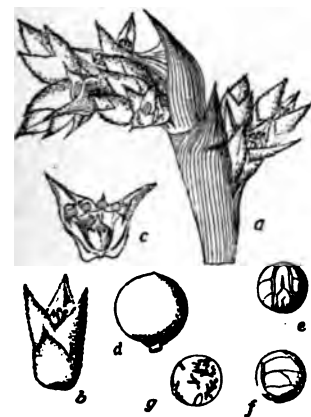
uses to which not only the fruits but also the stems and leaves are put by the natives of many tropical countries being enough of themselves to fill volumes. One prominent example of this great utility is the Palmyra palm, of which a Hindoo poet enumerated over 800 different uses. Other notable examples include



2728. Flowers and fruit of *Coccothrinax Miraguano*.—a, part of flowering branchlet; b, flower from which ovary has been removed, inner view; c, flower viewed, from behind; d, seed, with hilum in center; e, seed, upper surface; f, seed in transverse section; g, lengthwise section of seed, through embryo.

the coconut palm, the fruits of which are imported by hundreds of tons every year, and in addition to providing a valuable food, either fresh or in a desiccated condition, also produce that very valuable fiber from which cordage, matting and a great variety of goods are manufactured; also the Phoenix family, which produces the dates of commerce in apparently endless supply, and the date sugar of Bengal, this being contributed by *Phoenix sylvestris*, while the stems of date palms are often used in house-building in the East. Another very valuable palm product is found in palm oil, this being largely derived from the fruits of *Elais guineensis*, the oil being expressed from the ripe fruits in much the same manner that olive oil is manufactured. The rattan of commerce is chiefly composed of the flexible stems of various calamis, the plentiful supply of this material being sufficiently attested by the great variety of articles manufactured therefrom. Various palms have been mentioned under the name of "wine palm," but it seems likely that some species of *Raphia* are most used for liquors, some portions of these palms giving a large amount of sap when tapped, and as the juice is rich in sugar, the sap soon ferments and

may become strongly alcoholic. The best sago is produced from the pith of *Metroxylon* or *Sagus*, the trees being cut down and split into segments for the removal of the pith, the latter being then prepared in a rough granulated form for export. Sago is also procured from *Caryota* and some other genera, but the product is not equal to that of *Metroxylon*. The so-called whale-bone brooms frequently used in stables and for street-cleaning are mostly made from *Piassaba* (or *Piaçaba*) fiber, this being gathered from around the base of plants of *Attalea*, mostly *A. funifera*.



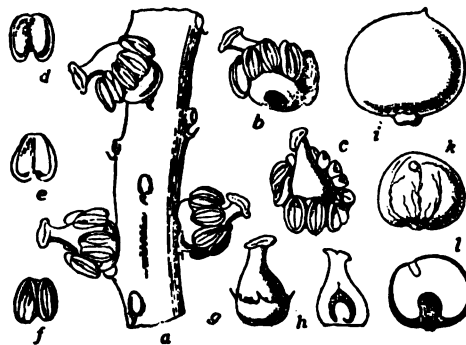
2729. Flowers and fruit of *Copernicia Curtissii*.—a, summit of flowering branch; b, single flower; c, flower in longitudinal section; d, fruit; e, seed, from the raphal side; f, seed, side view; g, seed in longitudinal section through embryo.

The *attaleas* also produce large seeds or nuts, those of *A. funifera* being known as coquilla-nuts, and very largely used for ornamental purposes, being very hard and capable of receiving a fine polish. Many small articles are manufactured from vegetable ivory, this being secured from the nuts of *Phytelephas macrocarpa*, a singular palm from South America, bearing a large fruit in which are contained from six to nine of the ivory-nuts, the plant itself having a short and sometimes creeping stem from which proceeds a noble head of pinnate fronds that are frequently 15 to 20 feet in length. The seeds of *Areca catechu*, after preparation with lime and the leaves of the pepper-plant, become the betel-nut of the East Indies, so much used by the natives of that portion of the world as a mild stimulant. The cabbage palm of the West Indies is *Oreodoxa oleracea*, the smooth and straight stems of which are frequently 80 to 100 feet high, and the removal of the "cabbage," so-called, means the destruction of such a tree, for the portion eaten is composed of the central bud in which the young leaves are compactly gathered together.

Botanical structure.

As the trunk of the palm rises, the leaves underneath the crown die and fall. Usually the old petioles, or

their bases, remain for some time, forming a shaggy capital to the column; this is well marked in the large or cabbage palmetto of the South. The palms are mostly trees, and sometimes rise to the height of nearly 200 feet, but some are climbing and others are low shrubs. Some palms are only a foot or two tall at



2730. Flowers and fruit of *Hemithrinax compacta*.—a, part of flowering branchlet; b, c, flowers in anthesis; d, e, anthers, from dorsal side; f, anther from inner side; g, flower with anthers removed; h, lengthwise section of ovary; i, fruit; j, seed; k, lengthwise section of seed, showing embryo.

maturity, as *Malortiea*. In some species the stems are prickly. Usually they make very straight comely boles, but a few species produce branches above.

The inflorescence of palms usually arises underneath or in the crown, from the axils of the leaves. The clusters are really spadices, although often branched, and are covered in the bud by a dry spathe composed of one or several leaves or parts. The remains of these spathes are well shown in Fig. 2538 (page 2298). In the upper cluster on the left, the spathe is arching over the fruits. The blossoms are relatively small, and usually dull colored and not showy, but in some species the spadix is scarlet or yellow and often very gracefully branched. The spathes are sometimes immense woody coverings, like troughs or bowls.

The flowers of palms are not greatly differentiated or specialized. The essential structure may be understood by comparing the details in Figs. 2725 to 2731, which are adapted from Beccari's account of palms indigenous to Cuba in *Pomona College Journal of Economic Botany*, February, 1913. Of most palms, the flowers are small or minute, quite regular, and they may be either hermaphrodite, monœcious, or dioecious. Often the whole flower is nearly woody, even the perianth-parts being hard and scarcely resembling petals. In most species there are two series of perianth-parts: three distinct imbricated sepals inclosing three distinct or partially united petals. Many modifications of this arrangement are known, however, as in the case of cer-



2731. Flowers of *Copernicia glabrescens*.—a, summit of flowering branch; b, top view of open flower; c, flower, side view; d, flower in longitudinal section.

tain species of *Thrinax* where the perianth is reduced and deformed, and of *Nenga* where the sepals are longer than the petals. There are nearly always six stamens, both in the pistillate and staminate flowers, and except in certain species of *Oreodoxa* (*Roystonea*) they are always included. They are often in two series, one opposite the sepals, the other opposite the petals, always free, and nearly always inserted on the short perianth-tube. The anthers are linear, oblong or arrow-shaped, two-celled, the pollen usually ellipsoid or nearly round, very rarely minutely spiny. The ovary is free, ovoid or oblong or globose, and often found in a rudimentary form even in staminate flowers, but sometimes lacking in the latter. There are mostly three cells, but four and even up to seven cells are known in rare cases. The ovule in each cell is solitary and almost always erect.

Great variety characterizes palm fruits. Some are dry and hard almost stone-like fruits, others are fleshy and even drupe-like. In many species there is a hard fibrous coating to the fruit, as in the case of the coco-



2732. A palm-house.

nut. In other species the seed is free, but often it adheres to the inner coat of the fruit; it nearly always contains a copious albumen.

The individual flowers and fruits of palms are borne on a large inflorescence (spadix) which may or may not be inclosed in a sheath-like structure (spathe). The form and branching of this spadix varies much. One character that seems to hold is that of the branching, in one group of genera the spadix being either simple or imperfectly branched, if compound then paniculate, such as is found in *Geonoma*, *Euterpe*, and allied genera; and in others the spadix is always pinnately branched, the ultimate branches distichous if greater ramification is present.

Horticultural importance, and culture.

Palms have been favorite greenhouse subjects from the period of the first development of the glass plant-house. The stereotyped form of conservatory is a broad or nearly square structure, with narrow benches around the sides over the heating-pipes and a palm-bed in the center. In these conservatories a variety of palms will succeed, requiring neither a very high temperature nor much direct sunlight. (Fig. 2732.) In fact, palms usually succeed best under shaded roofs. The

palms are most satisfactory in their young state, before the trunks become very prominent, and before the crowns reach the glass. The larger number in houses have pinnate or pinnatisect leaves, and these species are usually the more graceful in habit, although the fan palms are also much prized. Small palms are now in great demand for room and table decoration, and a few species are grown in enormous quantities for this trade. They are sold when small. They usually perish before they are large enough to be cumbersome. Among the most popular of these palms are *Chrysalidocarpus lutescens*, *Howea Belmoreana* and *H. Forsteriana*, *Cocos Weddelliana*, *Livistona chinensis*, and possibly one or two species of *Phoenix*.

Some palms endure considerable frost without injury. Of such are the sabals and the palmettoes of the southern states. The saw palmetto (*Serenoa serrulata*) and the blue palmetto (*Rhapidophyllum Hystrix*) occur as far north as South Carolina. In Asia, *Nannorhops* occurs naturally as far north as 34° and grows in the mountains of Afghanistan where snow falls, and in Europe. *Chamærops* (the only palm indigenous to Europe) reaches 44°.

The genera chiefly known to horticulturists are the following:

TRIBE ARECÆ. *Lvs. pinnatisect, the lfts. free or joined so as to form a plaited limb, the sides in vernation reduplicate: fls. monœcious or diœcious: seeds umbilicate, with ventral raphe and dorsal embryo.*

Areca, *Pinanga*, *Kentia*, *Hydriastele*, *Kentiopsis*, *Hedyscepe*, *Nenga*, *Archontophœnix*, *Rhopalostylis*, *Dictyosperma*, *Ptychosperma*, *Cyrtostachys*, *Drymophloeus*, *Cyphophœnix*, *Clinostigma*, *Cyphosperma*, *Euterpe*, *Acanthophœnix*, *Oreodoxa*, *Acrista*, *Bacularia*, *Linospadix*, *Howea*, *Ceroxylon*, *Verschaffeltia*, *Dypsis*, *Chamædorea*, *Hyophorbe*, *Roscheria*, *Geonoma*, *Calyptrigyne*, *Bentinckia*, *Wallichia*, *Didymosperma*, *Arenga*, *Caryota*, *Phytelephas*, *Pseudophœnix*, *Ænecarpus*.

TRIBE PHœNICÆ. *Lvs. pinnatisect, segms. acuminate and with induplicate sides in vernation: spadices interfoliar, the spathe solitary: fls. diœcious: carpels 3, only 1 maturing, the stigma terminal; seed strongly ventrally sulcate, the embryo usually dorsal.*

Phoenix.

TRIBE CORYPHEÆ. *Lvs. fan-shaped, wedge-shaped or orbicular, plaited, more or less cut, the lobes with induplicate sides: spadices interfoliar, the spathes many: fls. usually perfect; ovary entire or 3-lobed or sometimes the 1-3 carpels distinct, the ovule erect; pericarp usually smooth; seeds with ventral raphe and small hilum.*

Corypha, *Sabal*, *Washingtonia*, *Chamærops*, *Rhapidophyllum*, *Acanthorhiza*, *Brahea*, *Erythea*, *Pritchardia*, *Licuala*, *Livistona*, *Trachycarpus*, *Rhapis*, *Thrinax*, *Nannorhops*, *Serenoa*, *Copernicia*, *Teymannia*, *Trithrinax*, *Coccothrinax*.

TRIBE LEPIDOCARYÆ. *Lvs. pinnatisect or fan-shaped, the segms. with reduplicate sides in vernation: spadices terminal or axillary, the spathes numerous: fls. polygamo-monœcious; ovary entire, more or less 3-loculed: fr. clothed with reflexed, shining, imbricate, appressed scales; seed with dorsal raphe and ventral embryo.*

Calamus, Ceratolobus, Raphia.

TRIBE BORASSEÆ. *Lvs. orbicular, the segms. fan-shaped and the sides induplicate: spadices interfoliar, the spathes many and sheathing: fls. diœcious, the male minute and sunk in cavities on the spadix, the female very large, ovary entire, 3-loculed, the ovule ascending: fr. various.*

Borassus, Lodoicea, Latania, Hyphæne.

TRIBE COCOINEÆ. *Lvs. pinnatisect, the lfts. with reduplicate sides: spadices interfoliar, unisexual or androgynous, the spathe 2 or more: inferior fls. often in 3's, the middle one female; ovary 1-7-loculed: fr. large, drupe-like, 1-7-loculed, the stigma terminal, the endocarp or shell hard and woody and provided with 3-7 pores.*

Bactris, Astrocaryum, Acrocomia, Martinezia, Eleis, Diplothemium, Cocos, Maximiliana, Scheelea, Attalea, Jubæa, Desmoncus.

There is very little accessible monographic literature on the palms. Martius' "Historia Naturalis Palmarum," Munich, three volumes, 1823 to 1850, is a standard work. Kerchove de Denterghem's "Les Palmiers," Paris, 1878, is an important work. A popular running account of palms and the various kinds, by William Watson, will be found in the following places in *Gardeners' Chronicle*: 1884 (volume 22), pages 426, 522, 595, 728, 748; 1885 (volume 23), pages 338,



2733. Germination of *Chrysalidocarpus lutescens*.

410, 439; 1885 (volume 24), pages 362, 394, 586, 748; 1886 (volume 25), pages 75, 139, 557; 1886 (volume 26) pages 491, 652; 1887 (volume 2, series 3) pages 156, 304; 1891 (volume 9), pages 234, 298, 671; 1893 (volume 13), pages 260, 332.

Palm-culture, for decorative purposes in the United States, has made its greatest progress within the past twenty-five years, and now seems to be a well-established business, with the prospect of a steady increase as the adaptability of these plants becomes better understood. A great area of glass is now in use for palm-culture alone, the middle states being the center of this industry, though large numbers are also grown in a few southern states; and owing to a favorable climate and gradually improving business methods, it seems probable that American growers will soon be able to compete with their more experienced brethren of Europe in this class of plants.

The species most used in commercial horticulture in the United States are contained in a very short list, the greater quantity being confined to five species, namely, *Livistona chinensis*, *Howea Belmoreana*, *Howea Forsteriana*, *Chrysalidocarpus lutescens*, and *Cocos Weddelliana*, while less quantities of *Caryota urens*, several species of *Phoenix*, *P. canariensis* being very largely planted outdoors in the South and on portions of the Pacific coast, *Seaforthia elegans* and some others of the *Ptychosperma* group, and some few *livistonas* cover the extent of the catalogue for many growers.

Of these, the seeds are imported in most cases, and on the quality of these seeds the success of the grower depends, so far as getting up a stock is concerned. Most of these species germinate readily in a warm greenhouse, providing the seeds are fresh, the slowest of the common commercial palms being the *howeas*. In small quantities these seeds are usually sown in about 6-inch pots, the pots being well drained



2734. Germination of *Livistona*.

and nearly filled with light soil, then the seeds sown thickly and covered with $\frac{1}{2}$ inch of soil, watered thoroughly and placed where they may receive the benefit of some bottom heat; and at no time should they be allowed to become very dry. The period required for germination varies greatly with different species, *Livistona chinensis* germinating in two or three weeks if fresh, and being ready for potting in about two months, while seeds of some of the *attaleas* have been known to remain in the earth for fully three years before starting.

The seedlings of many species are very much alike, the seed-leaf in many instances being a long narrow simple leaflet, this description often applying equally to the seedlings of both fan-leaved and pinnate-leaved species; and from this fact it is somewhat difficult to recognize a species while in the juvenile form. Figs. 2733-2736 show stages in the germination of common palms. Special cultural notes for particular species of palms will be found throughout the *Cyclopedia*, but at this time a few general remarks regarding treatment of palms as a whole may be admissible. It has already been noted that palms in general are tropical in nature, and while there are a number of species that are found at considerable elevations, where the nights are decidedly cool, yet in a young state the same species may make more progress in a night temperature of 60° F.; and with this in view, a minimum temperature during the winter of 56° to 60° is safest for young and growing palms, while an advance of 15° to 20° during the day will not hurt them.

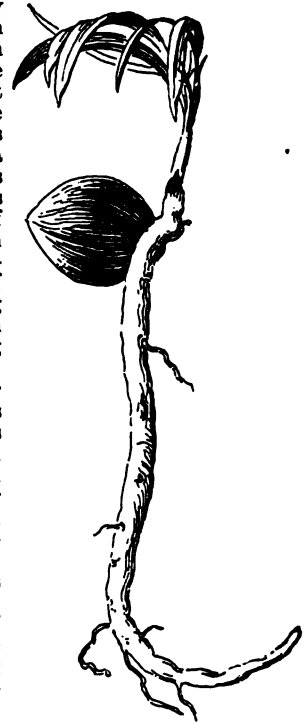
An abundance of water is required, for many palms grow on the banks of rivers or in swampy ground; and even those found on high and rocky ground send their roots down to such a depth as to find a liberal water-supply.

Rotted sod is the basis for the best soil for palms, and a fair proportion of stable manure is a safe fertilizer, such a soil being mixed with various proportions of peat or sand, to make it lighter and more open for some delicate species.

Insects are frequently troublesome if allowed to gain headway, various scale insects doing the greatest damage, while red-spiders and thrips may become established unless forcible syringing is persisted in. The most successful practice requires close observation on the part of the grower, and the prompt removal of all insects. Many other pests are also known and in the report of the Missouri Botanical Garden for 1898, Trelease gives an account of many of these. Busch in a report on investigation of diseases of the coconut palm in United States Department of Agriculture Bulletin of Entomology II. 38, 1902, gives an account of a disease that threatened the coconut industry in Trop. America.

Summer care of palms.

Some shading throughout the summer is best, the foliage grown under glass being more tender than that



2735. Germination of *Cocos Weddelliana*.

naturally produced outdoors. Repotting should be done during the spring and summer months, preferably, there being comparatively little root-action of the part of most palms between November 1 and March 1. Give only moderate-sized shifts, that is, use pots only 1 or 2 inches larger, and always ram the soil firmly.

Florists especially must understand the summer treatment of decorative palms. The usual weather of midsummer, which includes not only high temperature, but also fairly high humidity, is a help for the grower of palms, for such conditions do much to promote the growth of the stock, provided that watering, syringing, and proper attention to ventilation be given. A little ventilation at night, in addition to fairly liberal airing during the day, tends to prevent an over-accumulation of moisture on the foliage, and also has an influence toward the prevention of fungoid growths on or about the plants, for in houses so continually warm and moist as is the average palm-house, there is much encouragement for fungus on the woodwork of the benches and about the plants.

A sprinkling of slaked lime under the benches is also a help to the atmosphere and discourages snails to some extent, the latter pest being sometimes very troublesome, especially on the young growths of kentias. Two of the worst periods for the reproduction of scale insects are in the months of May and September, and if these pests can be kept down at those periods, there will be much less trouble in the remainder of the year.

Those who grow palms in quantity have to depend upon dips and spraying with various insecticides, from the fact that it is practically impossible to give the time to each plant that may be afforded by those who carry only a few dozens of palms in stock, but in either case most of the work of this character is likely to be done in the summer months, when there may be a little more time devoted to such work than can be spared in the busier seasons of spring and fall. This fact probably accounts for some of the insect tribulations to which the grower is exposed, as he is seldom able to find time to fight insects at the time of the spring rush, and by this means new colonies are distributed before the danger is appreciated.

Kentias and cocos are undoubtedly the palms for the million at this stage of the florists' art in America, and the necessities of these admirable plants are well understood. *Seaforthias* and *ptychospermas* were rather more common to the trade fifteen to twenty years ago than they are now, and were used for decorative work before the kentias absorbed so much attention. Instead of using *seaforthias* for decorating, persons are adding them to the outdoor garden in those parts of the South where palms add so greatly to the permanent effect in the outdoor planting.

The common *Phanix canariensis* and other strong-growing members of that subfamily are also frequently in demand for outdoor use, while the dwarf date, *Phanix Roebelenii*, continues to be in demand for house decoration, under which condition it is eminently satisfactory; it has found further usefulness even in small sizes, in being used to some extent for the centers of fern-pans. *Livistona rotundifolia* is one of the most charming of dwarf palms, but is easily spoiled by insects, requiring constant vigilance on that account, while a comparatively high temperature and moist atmosphere are also essential to its welfare.

W. H. TAPLIN.

L. H. B.

N. TAYLOR.†

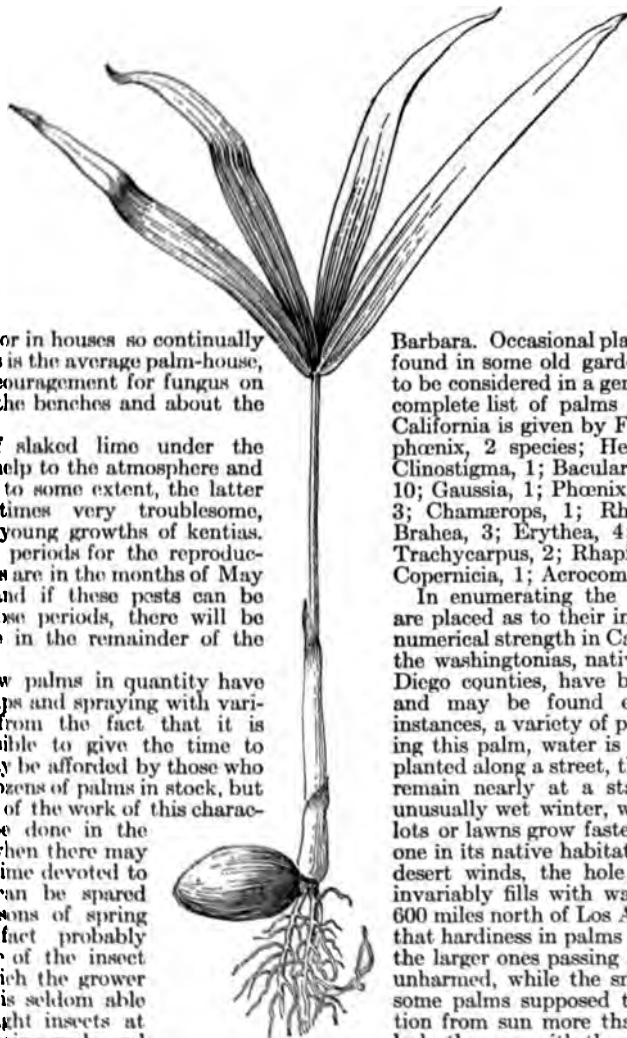
Palms in California.

Palms grown in the open in California gardens do not exceed about twenty-six genera, and numbering about eighty species. In this account may be found the species growing in the gardens of Los Angeles and vicinity, and throughout southern California in limited numbers from San Diego to Santa

Barbara. Occasional plants of species not mentioned are found in some old gardens, but are not so plentiful as to be considered in a general list of the hardy palms. A complete list of palms grown somewhere in southern California is given by Franceschi as follows: *Archontophoenix*, 2 species; *Hedyscepe*, 1; *Rhopalostylis*, 2; *Clinostigma*, 1; *Bacularia*, 1; *Howea*, 2; *Chamaedorea*, 10; *Gaussia*, 1; *Phoenix*, 10; *Sabal*, 10; *Washingtonia*, 3; *Chamaerops*, 1; *Rhaphidophyllum*, 1; *Serenoa*, 2; *Brahea*, 3; *Erythea*, 4; *Pritchardia*, 2; *Livistona*, 6; *Trachycarpus*, 2; *Rhapis*, 2; *Thrinax*, 2; *Trithrinax*, 2; *Copernicia*, 1; *Aerocoma*, 1; *Cocos*, 10; *Jubæa*, 1.

In enumerating the prevailing garden palms, they are placed as to their importance, or rather as to their numerical strength in California. The native fan-palms, the *washingtonias*, natives of San Bernardino and San Diego counties, have been most extensively planted, and may be found everywhere, serving, in some instances, a variety of purposes. (Fig. 2737.) In growing this palm, water is of the first importance. When planted along a street, those adjoining vacant lots often remain nearly at a standstill, except in case of an unusually wet winter, while those along the cultivated lots or lawns grow faster than any other palm. When one in its native habitat blows over by the force of the desert winds, the hole left by the roots and stump invariably fills with water. *Washingtonias* are hardy 600 miles north of Los Angeles. It may be well to state that hardness in palms is principally a question of size, the larger ones passing through the most severe winter unharmed, while the small ones may perish. So, also, some palms supposed to be very tender need protection from sun more than from frost. This is particularly the case with the so-called kentias and rhapis. A certain *howea* (or *Kentia Forsteriana*) is protected only by a large overhanging branch of a sycamore, which is of course leafless in cold weather, yet it has reached a height of 12 feet, with a diameter at base of 12 inches, and it has never been injured by frost, yet water hydrants 10 feet away have been frozen so hard as to burst them. In Los Angeles is a kentia 15 feet high, growing on the north side of a house, protected from sun alone, being 20 feet from the building, where for several winters the ground nearby has frozen to the depth of 1 inch. This is in the bottom-lands, the coldest part of the city.

Phanix dactylifera, although not so ornamental as others of the genus, was extensively planted in early



2736. Germination of *Howea Belmoreana*.

days and is one of the hardiest of palms (Fig. 2738). The most popular palm for the masses, who look for grace and beauty combined with cheapness, is *Phoenix canariensis*. More of these are planted at present than of any other three species. In Los Angeles and



2737. A sentinel palm.—*Washingtonia filifera*, San Jacinto Mountains, California.

vicinity they may be counted by tens of thousands. Like these two for hardiness is *P. reclinata*; and all may be seen growing north of San Francisco some 200 miles. All the genus is hardy in southern California. *Trachycarpus excelsus* and *Chamærops humilis*, the latter varying greatly in appearance, will grow as far north as any palms and are popular everywhere. The former in thirty years will grow to the height of 25 feet, while the latter will make 8 to 10 feet of trunk in the same time. *Livingstonia australis* and *L. chinensis* are both popular, though not hardy outside the southern part of the state, and the latter must be shaded from noonday sun. *Erythea armata* and *E. edulis* (often known as braheas) grow around San Francisco Bay luxuriantly. The dwarf sections of *Cocos*, represented chiefly by the one known in the trade as *Cocos australis*, is hardy even farther north than the erytheas, and are by far the most ornamental palms to be found in that section. Other *cocos* in southern California are *C. flexuosa*, *C. plumosa*, *C. coronata*, *C. Romanzoffiana*, and many others. Any *cocos* will grow here in protected places except *C. Weddelliana*. Palms of the *Cocos flexuosa-plumosa-Romanzoffiana* type are the most graceful grown, and at present very extensively planted in the southern citrus belt, sometimes for street or sidewalk trees. It is also one of the fastest growers, and will reach 20 feet in fifteen years, with ordinary care. *Archontophoenix Alexandræ* and *A. Cunninghamii*, the most elegant of our palms after the *Cocos plumosa* type, are not quite so hardy but will thrive from Santa Barbara southward, in warm locations. The same exposures, with shade during the hottest part of the day, will do for *Hedyscepe Canterburyana* and *Howea Forsteriana* and *H. Belmoreana*; also *Rhopalostylis Baueri* and *R. sapida*. The

four species of *sabals* seem to thrive and seed well in this section, though *S. Palmetto* and *S. Blackburnianum* grow much faster than the others. *Rhapidophyllum Hystrix* is perfectly hardy, but on account of its dwarf habit is not so extensively planted as its merits deserve. *Rhapis flabelliformis* and *R. humilis* need protection from sun alone, though there is a *rhapis* growing for ten years without protection from either sun or frost, and in the coldest section of Los Angeles, but its color is not all that could be desired. *Chamædoreas* are planted only where they can be protected from both frost and sun, though they thrive better under such circumstances than they do under glass. In such situations they are just the plant for the purpose, as they do not grow away from the protecting tree as do sun- and light-loving palms, but remain erect. *Brahea dulcis* may occasionally be seen, but grows too slowly to be popular. One of the grandest and hardiest palms, one that deserves for many reasons to be more extensively planted, is *Jubæa spectabilis*. There are a few specimens 20 feet in height with a bole 4 feet in diameter.

List of California palms. (Wright.)

The following list of palms for southern California has been compiled from many years of observation by J. Harrison Wright. While not entirely complete as regards the newest and untried introductions, it covers all the hardier species and it is made with special reference to the effects of the severe frosts of January, 1913.

I. HARDY PALMS.

Withstand a minimum temperature of 18° to 20° F. with little or no injury.

<i>Chamærops humilis</i> (in a dozen varieties).	<i>Phoenix reclinata</i> .
<i>Cocos Alphonsei</i> .	<i>Phoenix sylvestris</i> .
<i>Cocos Bonnetii</i> .	<i>Sabal Adansonii</i> .
<i>Cocos campestris</i> .	<i>Sabal Blackburniana</i> .
<i>Cocos eriocephala</i> .	<i>Sabal mexicana</i> .
<i>Cocos flexuosa</i> (of Hort.).	<i>Sabal Palmetto</i> .
<i>Cocos Gaertneri</i> .	<i>Sabal princeps</i> .
<i>Cocos Yatay</i> .	<i>Serenoa serrulata</i> .
<i>Erythea armata</i> .	<i>Trachycarpus excelsus</i> .
<i>Erythea edulis</i> .	<i>Trachycarpus Martiana</i> .
<i>Jubæa spectabilis</i> .	<i>Washingtonia gracilis</i> .
<i>Phoenix canariensis</i> .	<i>Washingtonia robusta</i> .
<i>Phoenix dactylifera</i> .	<i>Washingtonia Sonora</i> .



2738. Date palms at Old Town, San Diego.

The following require protection from sun in the interior valleys:

<i>Livistona australis.</i>	<i>Rhapidophyllum Hystrix.</i>
<i>Livistona chinensis.</i>	<i>Rhapis flabelliformis.</i>
<i>Phoenix Robelenii.</i>	<i>Rhapis humilis.</i>

The above are rather generally found and to them may be added the following, equally hardy but not yet in general cultivation:

<i>Brahea calcarata.</i>	<i>Cocos australis (true).</i>
<i>Brahea Pimo.</i>	<i>Cocos Datil.</i>
<i>Cocos Arechavaletana.</i>	

Above are tall-growing Cocos of the plumosa type but hardy.

<i>Cocos odorata.</i>	<i>Nannorhops Ritchiana.</i>
<i>Cocos pulposa.</i>	<i>Trachycarpus caespitosa.</i>
<i>Erythea Brandegei.</i>	<i>Trithrinax brasiliensis.</i>
<i>Erythea elegans.</i>	<i>Trithrinax campestris.</i>

All the above can be grown wherever oranges are planted, and in addition the following are at home on the hill section of Los Angeles, in the frost-free foothills and sheltered coastal valleys like Santa Barbara and the Montecito.

II. TENDER PALMS.

<i>Chamedorea deemoncoides.</i>	<i>Livistona Marise.</i>
<i>Chamedorea elegans.</i>	<i>Phoenix rupicola.</i>
<i>Cocos botryophora.</i>	<i>Pritchardia Gaudichaudii.</i>
<i>Cocos plumosa.</i>	<i>Pritchardia pacifica.</i>
<i>Cocos Marise-Regina.</i>	<i>Ptychosperma Alexandræ.</i>
<i>Cocos Romanoffiana.</i>	<i>Ptychosperma Cunninghamiana (Seaforthia).</i>
<i>Howea Belmoreana.</i>	<i>Rhopalostylis Baueri.</i>
<i>Howea Forsteriana.</i>	<i>Rhopalostylis sapida.</i>
<i>Livistona Jenkinsoniana.</i>	

The following have been recently introduced, but are not thoroughly tested:

<i>Ceroxylon andicolum.</i>	<i>Livistona decipiens.</i>
<i>Copernicia australis.</i>	<i>Sabal Uresana.</i>
<i>Juania australis.</i>	<i>Sabal Exul.</i>

[*Juania australis*, Drude, representing a monotypic genus in the Island Juan Fernandez (and for the first word of which it is named), is an unarmed palm with pinnatisect terminal lvs. allied to *Ceroxylon*: lf. segms. long and narrow, acuminate, whitish beneath, thickened on the margins: fr. globular, size of a cherry.]

ERNEST BRAUNTON.

Hardy palms in Florida.

A large proportion of the various species of palms tried by the writer in Florida have succeeded from moderately to exceedingly well. Close to 200 species belonging to some 60 genera have been in cultivation and of these more than 150 are surviving. The state itself is rich in palms for a region lying wholly outside the tropics, there being not less than fifteen native and one naturalized species, the latter the common coconut, found within its borders. A few of these, such as *Sabal Palmetto*, *Serenoa serrulata* and *Rhapidophyllum* among native forms, and one or two species of *Trachycarpus*, one or two of the dates, *Jubæa spectabilis* and *Washingtonia* should be fairly hardy, especially along the coastal region, throughout most of the northern part of the state.

Most of the palms which do well in this state succeed on ordinary pine land, but their growth would be improved if a liberal amount of muck or leaf-mold was incorporated with the soil, and a heavy mulch is always beneficial. Of course in poor soils a good fertilizer is necessary and it is an excellent plan to apply one rich in potash in the fall in order to harden up the growth for winter.

Nearly all the palms must be propagated from seed; only a few are caespitose, such as *chrysalidocarpus*, *rhapis*, most of the *phoenix* and *chamedoreas*, and these can often be propagated from suckers. When these are thrown out above the ground it is best to make an incision at their bases and set a flower-pot underneath, mounding up with earth around the sucker, when it

will generally throw out roots into the pot, after which it may be severed and the whole removed.

The entire state is subject to "northers" during which the wind blows from the northwest, and cold weather and frost may occur in any part of the state. A large part of the palms which can be grown in Florida are tropical and if their seeds when in the ground are subjected to such a degree of cold they are almost sure to perish. If one is propagating any considerable number of palms, it will pay to have a frame covered with a sash or sashes. This can be sunk in the ground if necessary; the seeds should be planted in good soil, and during cold nights the whole may be heavily covered with fertilizer sacks. It should have a southern exposure and be well protected from the wind. In the southern part of the state such a pit, if covered early and thoroughly on cold nights, will generally answer all purposes, but if one could have a small glass house with



2739. A digitate-leaved palm, one of the best palms for small conservatories—*Rhapis flabelliformis*.

a bench along one side it would be better. The space in front and below it could be closed up and under the shelf a small kerosene stove or lamp could be kept going during cold nights. This would furnish bottom heat for the seeds planted on the bench and thus insure their germination.

Fairly good-sized palms are best for planting in the open ground, say from 4- or 5-inch pots. Water well and mulch, then shelter by setting palmetto leaves around the plant so as to shade it. In case of danger of frost, mound up around the stem to above the growing point with dry soil and if the leaves are frozen the plant will not be seriously injured.

The following notes are drawn from experience in the cultivation of these palms in central and southern Florida.

Acalorraphe Wrightii grows in marl land on the southern shore of the mainland of Florida. It forms very dense, attractive clumps 30 feet or more across.

Acrocomia. Rapid growers, and *A. Totai* is hardy in the southern half of Florida. It will not grow in dry or poor soils, but thrives in rich moist lands. Like most palms, this species is very responsive to an application of commercial fertilizer—from a pound to ten pounds according to the size of the plant. *A. media*, from Porto Rico, is an exceptionally vigorous grower.

Archontophoenix. The two species, *A. Cunninghamii* and *A. Alezandra*, which are such favorites in the North, are among the best palms in Florida, and will, without doubt, become favorites in the lower third of the state. They succeed well in shade or sunshine, on pine or hammock land, and are fairly rapid growers, the former being somewhat the stronger plant.

Areca glaudiformis is a superb, rapid-growing palm which grows well in pine land; *A. triandra* is an elegant species, which should probably be grown in the shade, and the same may be said of *A. Aliceae*. All are tropical.

Arenga saccharifera is a noble palm and does well in pine land.

Attalea. Prefers rich soil and if well grown makes magnificent specimens. *A. Cohune* succeeds well in southern Florida, and also *A. gomphococca*.

Bactris. None of the species thrives in southern Florida.

Caryota. Several species are cultivated in lower Florida. Sometimes the specimens do well; at other times they fail. When in bloom they are among the most striking of palms. The ends of the leaflets are subject to a blight which decidedly injures the growth of many specimens.

Chamædorea. Lovely, often caespitose palms with reed-like stems. They are probably all tender, and do well in southern Florida in sheltered, more or less shaded places.

Chamærops. All of these do well in southern Florida and would doubtless prove hardy throughout a large part of the state. They are slow growers, especially until they attain to considerable size. *C. humilis* thrives best on high dry soils. The flowers, resembling a flat yellow fringe from a distance, appear in March, and exhale a very strong, aromatic perfume. All produce numerous suckers which should not be removed. Planted in small groups 10 to 15 feet apart, they soon form very beautiful specimens which look best in the foreground of magnolias or other taller palms. Each plant should receive a mulch of stable manure in March or April, and some good commercial fertilizers during the rainy season.

Chrysalidocarpus lutescens is a well-known palm in the North, and in southern Florida it forms large clumps 20 or 25 feet high.

Coccothrinax jucunda and *C. Garberi* are elegant, low-growing palms from the extreme southern part of Florida and are as easily grown as the species of *Thrinax*.

Cocos. All species of *Cocos* do well in southern Florida except *C. insignis* and *C. Weddelliana*. The common coconut, *C. nucifera*, save that it sometimes is injured by frost, does as well as in many parts of the tropics and it is grown more than all other palms put together. It ripens nuts and is becoming naturalized in Dade and Monroe counties. *C. plumosa* and the species of its section are beautiful, rapid growers and all the australis section succeed admirably. The various species are sometimes attacked by what is apparently a fungous disease appearing as brown streaks in the young leaves. The only remedy is to pull the leaves apart and cut out the injured young leaf back as near the growing bud as possible. This may have to be repeated once or twice. This same disease attacks the royal palms, which may be treated in the same way. All the species do well on high pine land, if well fertilized and watered during long dry spells. The tall-growing, slender-stemmed species like *C. plumosa*, *C. flexuosa*, *C. Romanzoffiana* and *C. coronata* are hardy as far north as central Florida. The species and varieties of the australis group—*C. australis*, *C. eriopatha*, *C. Datil*, *C. Gaertneri*, *C. Yatay*—are better adapted to high pine land than most palms. They soon form beautiful specimens, flower regularly when only a few years old, and bear large bunches of edible fruit, sometimes as large as a big cherry or small plum. The fertilizers to be used for these palms should be equally rich in ammonia, phosphoric acid and potash. This should be applied in the months of December, January, and February. All the old dry leaves, spathes and fruit-stems should be removed at the end of September.

Copernicia. A fine group of fan-leaved palms which is abundantly developed in Cuba.

Corypha. None of the species seems to thrive in Florida.

Demonorops. Tender, and easily killed during cold spells in lower Florida.

Dictyosperma. Two species are grown in southern Florida, *D. rubra* and *D. alba*. Both are fine palms and when established are strong growers and soon make bold and beautiful specimens. They are harder than some of the tropical species.

Elæis, the oil-palm of tropical Africa, is grown to some extent in lower Florida and it has produced perfect seeds. It seems to be a rank feeder and if planted in pine land should be well fertilized.

Erythea edulis and *E. armata* should be hardy throughout the southern half of Florida.

Goussia princeps grows abundantly on limestone cliffs in the mountains of Cuba, and promises to do well also in southern Florida.

Geonoma. Species of this genus are doing moderately well in southern Florida planted in a shaded situation in the edge of the hammock.

Hedyoscepe Canterburyana is doing excellently in southern Florida and should be hardy throughout the greater part of the state.

Hovea. These palms do not seem to do well in Florida, although they should be hardy over the southern half of the state.

Hydriastele Wendlandiana is a handsome, rapid-growing palm which promises well when planted in partial shade in fairly good pine land. As it is a native of Queensland it is, no doubt, tender.

Hyophorbe amariculus and *H. Verschaffeltii* are strikingly ornamental, richly colored palms which are doing fairly well in lower Florida. Both have bottle-shaped caudices.

Hyphæne Schatan has been introduced into southern Florida and does well in pine land, although very tender. It has massive leaves with spiny-edged petioles.

Jubæa. The species grow very slowly. *J. spectabilis* should be hardy throughout Florida.

Latania. The latanias are among our noblest and most beautiful palms; *L. Loddigesii* is very robust and *L. Commersonii*, although

not so strong a grower, is very fine. They will grow in salty soil and stand salt air well, but are tender.

Licuala. Tropical palms from the Orient which do not do well in southern Florida. *L. grandis* and one or two others have succeeded for a short time, but soon die.

Livistona. Most of the species do well in southern Florida. *L. chinensis* and *L. australis* will probably prove hardy as far north as latitude 27°. They require rich moist soil. *L. rotundifolia*, *L. albasima*, *L. Hoogendorpii*, *L. subglobosa* and *L. Jenkinsiana* are fine tropical species.

Martinezia caryotefolia is cultivated in southern Florida and seems to do best in a sheltered and partly shaded situation.

Nipa. This grows successfully in brackish marshes in southern Florida, although often destroyed by land crabs.

Oreodoxa. The species of this genus are unsurpassed for majesty and grace by anything in the vegetable kingdom. The common royal palm, *O. regia*, grows in the greatest abundance almost everywhere throughout the island of Cuba and is universally respected and loved by the natives. It is generally a rather slender tree, rarely over 70 feet high and, as a rule, has a swelling somewhere along the stem. O. F. Cook considers that the species growing in the extreme lower end of this state is distinct and has named it *Roystonea floridana*. It grows to a height of 100 feet or more, the stem is not often swollen and the seeds are smaller than those of Cuban trees. Both flourish on rich or moist soil over the lower third of the state. *O. Boringuana* is a stouter species which will probably do well where the Cuban species will, while *O. oleracea* is a lofty growing species that is much tenderer. They generally do not succeed well on pine land but will do fairly well if abundantly mulched and treated with muck, especially if they are irrigated.

Phœnix. All species and varieties of the date palm grow exceedingly well in Florida, and all the smaller kinds growing in tufts fruit abundantly, as do also the hybrids between *P. dactylifera* and *P. sylvestris*. They flourish equally well on pine, hammock or swamp land, even in brackish marshes. *P. dactylifera*, *P. canariensis* and *P. sylvestris* are hardy in northern Florida. Hybrids between these three are numerous. The tufted kinds like *P. reclinata*, *P. paludosa*, *P. farinifera* and their varieties form magnificent specimens of medium size when well cared for. *P. humilis* and *P. Roebelenii* grow best in rich moist somewhat shaded soil. For the large-growing species like *P. canariensis* and *P. sylvestris*, and for all the large-growing palmettos (sabals) it is necessary to make special preparations before setting them out on high pine land. Dig a hole 6 feet deep and 6 feet wide. Old tin cans, bones, rotten oak wood should be placed at the bottom, then stable manure mixed with clay should follow. The upper 2 feet of the hole should be filled in with surface soil mixed with well-rotted manure. Three- or 4-foot specimens should be set out in such places. They will grow very fast and will form beautiful specimens within a few years. On low moist soils and in hammock woods, such preparations are not so necessary. But wherever planted, all palms need two good applications of fertilizer each year. A good plan is to mulch the plants in April and May with stable manure. This should be dug in around the plants in October, and a good application of commercial fertilizer rich in potash should follow immediately. Potash serves to harden the plants and makes them more resistant to cold.

Phytelphas macrocarpa succeeds well in southern Florida.

Pritchardia. A few species of magnificent fan-leaved palms from the South Seas, all of which are excessively tender in Florida. They can be grown in the more tropical parts of the state in sheltered places but are liable to have their leaves disfigured by frost.

Pseudophœnix Sargentii has been found rather abundantly on Elliott's Key, one of the northernmost of the lower chain. It is cultivated somewhat in southern Florida and when young is rather attractive but when old it has exceedingly dark foliage and is rather stiff and formal.

Ptychosperma Macarthurii is an elegant tufted palm which succeeds finely in southern Florida. It should have partial shade and shelter and if well fertilized it soon becomes a most attractive object.

Rhapidophyllum. This beautiful little palm is a native of northern and central Florida where it grows on low shaded ground. The low stems are covered with a very thick spongy mass of a peat-like substance. It is easily removed and thrives in any soil, even on high pine land. It does not need much water or fertilizer.

Rhapis. Slender, tufted, low-growing palms which are hardy in Florida and require moist soil and a shady place. *R. humilis* is the most elegant species, growing in dense clumps about 7 feet high. *R. flabelliformis* is more inclined to spread.

Roscheria. Young plants of *R. melanochates* do well in southern Florida, in sheltered situations.

Sabal. In good rich moist soil all the sabals grow well and soon form fine specimens. Such soils need no special care before planting, but good applications of fertilizers are necessary, if fine-looking and thrifty specimens are desired. All do well, however, on high dry pine land soils if well watered and fertilized. If not well taken care of they are exceedingly slow growers. *S. Blackburnianum* has immense leaves, while those of the somewhat glaucous-colored *S. mauritiforme* are scarcely of less size. *S. mexicanum* resembles the native *S. Palmetto*. There are a number of distinct varieties, such as *S. havanensis* and *S. princeps*. The species which do not form a trunk, like *S. Adansoni*, are only desirable for large palm collections.

Serenoa. Common on high pine lands as well as in rich hammocks. It grows in dense clumps and when given an opportunity to grow makes a very ornamental plant.

Stevensonia grandifolia is a magnificent palm but seems to be excessively tender in Florida. Perhaps it would succeed with protection until it attained considerable size.

Thrinax. The species of this fine genus do remarkably well in all kinds of situations and soils. They are all tropical and the beauty of the leaves is destroyed by frost. *T. Wendlandiana*, *T. floridana*, *T. microcarpa* and *T. keyensis* are natives of the extreme southern end of the state and are all fine. *T. barbadensis* and *T. Morrisii* are elegant species, the latter being dwarf. The magnificent leaves of *T. altissima* are liable to be injured by winds if planted in an exposed place.

Trachycarpus. These palms do not seem to thrive well in Florida, although a few specimens of *T. excelsus* in the central part of the state are doing well.

Verschaffeltia also does not thrive in Florida.

Wallichia caryotoides thrives in shady positions in southern Florida.

Washingtonia. Three distinct species are grown in Florida. *W. robusta* is one of our finest palms, growing rapidly and vigorously in pine land and it is used to some extent for planting along streets and roads. *W. filifera* is not so handsome a tree or so rapid a grower as *W. robusta* but it is doing well. *W. Sonora* promises well here. Everywhere in Florida where the soil is moist, the *Washingtonias* grow to perfection. They will not thrive on high dry ground. They will occasionally require good applications of fertilisers.

CHAS. T. SIMPSON.

H. NEHRLING.

PALMERÉLLA (Dr. Edward Palmer, American botanical collector, discoverer of the original species). *Campanulaceæ*. A genus of two or three species, with small blue fls. like those of a lobelia. The genus differs from *Lobelia* in the adnation of the stamens, as well as in the entire or closed corolla-tube, at least its upper part, but which soon splits from the base upward for a good distance, and before withering the lower part of the corolla is much disposed to separate into five claws (liberating also the lower part of the filaments); filaments adnate to the corolla-tube to near the throat and then monadelphous and adnate on one side or the other, or free; nectary an imperfect tubular cavity in the throat of the corolla.—Herbs of S. Calif. and Mex., very little known horticulturally.

débilis, Gray. Slender glabrous branching perennial herb, 2 ft. high, very leafy: lvs. alternate, linear-lanceolate, entire, sessile, 2-3 in. long; floral ones gradually reduced to bracts: raceme lax, few-flid.; corolla-tube whitish, 9 lines long, lobes light blue, 2 of them smaller than the others, the larger ones 3-4 lines long. S. Calif. and Low. Calif. Var. *serrata*, Gray, was offered in 1881 but it is probably not in cult.: infl. and corolla-tube somewhat puberulent: lvs. (except the upper ones) sharp-serrate, the lowest spatulate and obovate. S. Calif.

L. H. B.

PALMETTO: *Sabal*.

PALMS, POPULAR NAMES OF: *Alexandra P.*, *Archontophoenix Alexandræ*. *Assai P.*, *Euterpe edulis*. *Betel-nut P.*, *Areca Catechu*. *Blue P.*, *Erythea armata*. *Blue Palmetto*, *Rhapidophyllum*. *Bourbon P.*, *Lalania*. *Broom P.*, *Attalea funifera* and *Thrinax argentea*. *Cabbage P.*, *Euterpe oleracea*. *Club P.*, *Cordylina*. *Coconut P.*, *Cocos nucifera*; *Double Coconut* or *Sea Coconut P.*, *Lodoicea*. *Coquito P.*, *Jubæa spectabilis*. *Corojo P.*, *Acrocomia sclerocarpa*. *Curly P.*, *Howea Belmoreana*. *Date P.*, *Phoenix dactylifera*. *European P.*, *Chamærops humilis*. *Fan P.*, any species with fan-shaped, rather than pinnate lvs. *Fern P.*, *Cycas*. *Fish-tail P.*, *Caryota urens*. *Flat P.*, *Howea Forsteriana*. *Guadeloupe P.*, *Erythea edulis*. *Gru-gru P.*, *Astrocaryum vulgare* and *Acrocomia sclerocarpa*. *Hemp P.*, *Chamærops excelsa*. *Ivory-nut P.*, *Phylephas macrocarpa*. *Needle P.*, *Rhapidophyllum*. *Nikau P.*, *Rhopalostylis*. *Nipa P.*, *Nipa*. *Norfolk Island P.*, *Rhopalostylis Baueri*. *Oil P.*, *Elæis guineensis*; also *Cocos butyracea*, etc. *Palmetto P.*, *Sabal*. *Serenoa*. *Panama-hat P.*, *Carludovica palmata*. *Para P.*, *Euterpe edulis*. *Raffia P.*, *Raphia*. *Royal P.*, *Oreodoxa regia*. *Sago P.*, various species of *Metrozylon* and *Cycas*. *Savanah P.*, *Sabal mauritiformis*. *Saw P.*, or *Palmetto*, *Serenoa*. *Talipot P.*, *Corypha umbraculifera*. *Thatch P.*, *Sabal Blackburniana*; *Howea Forsteriana*. *Toddy P.*, *Caryota urens*. *Umbrella P.*, *Hedyscepe Canterburyana*. *Walking-stick P.*, *Baccharia monostachya*. *Wax P.*,

Cerozylon. *Wine P.* of E. Indies, *Caryota urens*, *Phoenix sylvestris* and *Borassus flabelliformis*; of New Granada, *Cocos butyracea*.

PALUMBINA (said to be from *palumbes*, wood-pigeon; from a supposed resemblance of the fls.). *Orchidaceæ*. A monotypic genus greatly resembling *Oncidium*, with which it was formerly united. It differs principally in having the lateral sepals entirely united, forming a single segm. resembling the dorsal sepal in shape and size, the labellum scarcely larger than the petals and resembling them in shape.

candida, Reichb. f. The only species is a small plant with narrow, compressed pseudobulbs, each with a single slender lf., 6-12 in. long: fls. few, small, white, in a slender raceme; sepals, petals and labellum oblong, acute, differing but little in size and shape. Guatemala. B.M. 5546. G.C. 1865:793; II. 20:233 (as *Oncidium candidum*).—May be easily grown in a temperate house. Blooms in summer, the fls. lasting a long time.

HEINRICH HASSELBRING.

PAMBÛRUS (from the Singhalese name *Pamburu*). *Rutaceæ*, tribe *Citrea*. Small trees distantly related to *Citrus* but bearing frs. filled with gum: young branches often angled; older ones rounded, spines solitary or paired in the axils of the lvs.: lvs. simple, thick, gray-green: fls. 4-5-parted (usually 4) with 8-10 stamens; pistil supported on a subcylindric disk.—Only one species is known.

missionis, Swingle (*Limonia missionis*, Wall. ex Wight. *Atalantia missionis*, Oliver). Lvs. simple, elliptic-oblong, short-petioled, showing veins only very obscurely, wrinkling at the margins on drying: fls. in axillary racemes, shorter than the lvs.; filaments slender, anthers linear-oblong, disk long and slender; ovary 4-5-celled, with 2 ovules in each cell: fr. 1 in. diam., filled with a mucilaginous fluid. Ill. Wight, Ill. Ind. Bot. v. 3, pl. 33. Swingle, Journ. Wash. Acad. 6:336.—This tree occurs in India and Ceylon in sandy soil near the seacoast. It should be tested as a stock for *Citrus*. The wood is light-colored, but when variegated is used for furniture.

WALTER T. SWINGLE.

PAMPAS-GRASS (*Cortaderia argentea*, which see. Vol. II, p. 856.). A showy tall perennial subtropical grass grown for its whitish fluffy plumes of inflorescence; native in Argentina and southern Brazil.

The growing of pampas plumes for profit in California has been undertaken for over forty years. Pampas-grass was introduced into the United States about 1848. In the northern states it is frequently planted on the lawn in summer, and upon the approach of cold weather transferred in a tub to a cellar for winter protection. In California, a hill will sometimes attain a height of 20 feet, a diameter as great, and a weight of 2,000 pounds. Such plants would be very inconvenient for our northern friends to handle in the cellar.

Plants are easily produced from seed, but as the sex and variety are very uncertain, stock is usually increased by dividing the female plants, the plumes of which are much more beautiful than those of the male. The growing of pampas-grass in North America on a commercial scale dates from 1874, when the difference in sex was discovered. In 1872 the writer sowed seed which in two years gave several hundred plume-bearing plants. Even then the variations in color and fineness were very marked. In 1874, it was found that by pulling the immature plumes from the sheaths and exposing them to the hot sun, the male plumes would hang heavily like oats, while the female plumes would become fluffy, and light and airy. In November, 1874, samples of the female plumes were sent to Peter Henderson & Co., New York. Three hundred were ordered at once, and the following day instructions were received to double the order and send by express. This was the first lot of good plumes



LXXXIII. An avenue of palms in southern Florida.—*Oreodoxa regia*.

20

ever sent east from California, and was the beginning of the present pampas industry. The writer's plantation was increased each year until 1889, when it comprised about 5,000 hills. There were a number of other extensive plantations in the neighborhood of Santa Barbara. The crop of 1889 was estimated at 1,000,000 plumes. The demand has been good, but the prices have never been so high as at the beginning of the industry. The first prices were \$200 for 1,000 plumes. The decrease in price was gradual until 1886, when sales were slow at \$30 for 1,000 plumes. Some of the growers did not harvest their crops that year, and destroyed their plants. In the fall of 1887 plumes were in demand at \$40 the 1,000, and in 1888 they were scarce at \$50 and \$60 the 1,000. The following spring there was an increase in acreage. Since then the industry has had its ups and downs, and the price has ruled low for several years, the present prices being \$9 to \$10 for first-class, and \$5 to \$6 for second size.

Pampas-grass should be put on the best valley land, and set 10 by 16 feet apart. Before planting, the ground should be deeply plowed and put in first-class condition. In selecting stock, divide only female plants that produce the finest white plumes. Young hills produce the best plants. From old hills the best plants are obtained around the outside, those in the center of the stool being mostly worthless unless planted in large clumps. Some plumes will be produced the first year after planting. They will not be first-class, but are worth saving. The second year, if well grown, they should produce 80 to 150 plumes to the hill. Not all plantations will yield this much. The third and fourth years there will not be much change in the yield. As a plant gets older the plumes are larger but the yield is less. After 8 to 10 years a quantity of dead matter will have accumulated, and the hills should be trimmed or burned.

The appearance of the plumes is a signal for great activity among those who have large fields. The grass should be so trimmed early in September, before the plumes appear, that each hill will be easy of access. Young plants ripen their plumes two or three weeks earlier than old ones, and some varieties are earlier than others. It requires exercise of judgment to pick the plumes at the proper time. They are generally ready when they are exposed from the husk a few inches and have a fluffy look. It is well to try a few at this stage, and if they cure well at the stem end when dry they are all right, but if they do not become fluffy at the stem end they have been picked too young. If the plume looks dark and seedy at the top when cured, it was too old when picked. Some varieties, especially those producing very long plumes, should be allowed to remain somewhat longer on the plant than those of the short-plumed varieties. By trying a few of each variety, the time of ripening can soon be ascertained. Some varieties are pulled from the husk in the field; others have to be hauled to husking benches, where the husk or sheath is removed. Some planters husk them like corn; others use a knife set in such a way as to split the husk without injuring the plume. When the husk has been split, a quick jerk or strike on the table will extract the plume. The plumes are then taken to the drying ground and evenly spread in long rows. This ground should be made smooth and free from any trash that is liable to adhere to the plumes. Clean stubble ground is the best. The plumes are left on the ground three days and two nights to cure, and are turned and shaken once each day. They are next packed away as broadly and smoothly as possible on shelves in a dry building, where they should lie ten days or two weeks, or until the stems are thoroughly dried, at which time they are ready for market. They are packed in two grades: the first class, having plumes 26 inches long and over, clear of stem (sometimes as long as 45 inches), is packed in cases that hold three-quarters of a ton and contain 3,000 plumes; second-class stock is packed

in cases of the same size, the plumes being 17 to 26 inches long clear of stem, and 6,000 in each case. If shipping by express, the writer uses bales of about 2,000 plumes, covered with canvas or burlap and some light strips of wood at the corners. If the plumes are packed smoothly and evenly they will withstand heavy pressure. Careful all-round cultivation is necessary to produce good plumes.

The best market at present is London, the next Hamburg. Berlin, Denmark, New York and Philadelphia take a few. Pampas plumes are colored in London. In America the pure white plumes give the best satisfaction.

JOSEPH SEXTON.

PANAX (old Greek name, meaning *all healing* or a panacea). *Araliaceæ*. A genus of seven or eight species of hardy perennials none of which is of cultural importance except *P. quinquefolium*, Linn., the GINSENG, which see (Vol. III). They have aromatic roots, digitately compound leaves and greenish white flowers in a terminal umbel. They are all natives of the North Temperate Zone, mostly in Asia and North American. For an account of the tender plants heretofore included in this genus, see *Polyscias*.

The genus as now defined is distinguished by the thickish roots or tubers from which arise erect simple

short sts. bearing 1 whorl of 3 digitate lvs. which have 3 or 5 lfts.: umbels terminal and solitary, simple, bearing small white or greenish polygamous fls.; calyx obscurely 5-toothed; petals 5, spreading; stamens 5, alternating with petals; styles 2 or 3: fr. a 2- or 3-seeded little drupe. Two species are native in the eastern U. S. and Canada. *P. quinquefolium*, Linn. (*Ginseng quinquefolium*, Wood. *Aralia quinquefolia*, Decne. & Planch.).

GINSENG, growing in rich woods Que. to Minn. and south to Ala.: about 1 ft. high from a more or less branching thick root: lfts. usually 5, stalked, the basal pair much smaller than the others, all ovate or obovate, dentate, acuminate: peduncle an inch or two long, bearing a 6-20-fl. umbel; styles usually 2: fr. bright red. *P. trifolium*, Linn. (*Ginseng trifolium*, Wood. *Aralia trifolia*, Decne. & Planch.), GROUND-NUT (Fig. 2740), native in moist mostly low or flat woods, Nova Scotia to Iowa and Ga.: delicate little plant about 6 in. high, with a deep globular blackish tuber or root about 1/2 in. diam.: lfts. mostly 3, sessile, oval to oblanceolate, obtuse, serrate: peduncles an inch or two long, bearing a few whitish often monœcious fls.; styles usually 3: fr. 3-angled or 2-sided, yellowish. An attractive but not showy early spring bloomer, suitable for colonizing in moist shady places.

L. H. B.

PANCRACTIUM (Greek, *all-powerful*; referring to supposed medicinal value). *Amaryllidaceæ*. Attractive summer- and winter-flowering bulbs, bloomed inside or some of them grown outside in mild climates with protection.

Very like *Hymenocallis*, being the Old World representatives of this group, differing botanically in having many superposed ovules in each cell rather than (as in



2740. *Panax trifolium*.

Hymenocallis) 2 basal collateral ovules. Bulb tunicated: lvs. linear to lorate, mostly appearing with the fls., the latter in an umbel terminating an erect solid mostly stout scape or peduncle and white or greenish; perianth funnel-shaped, with a long tube, the segms. equal, short and spreading or ascending; stamens inserted at the throat of the perianth and joined by a web or cup: fr. a loculicidally 3-valved caps. with



2741. *Pancratium*: types of three sections.

At the right, the short perianth-tube and small staminal cup of *P. illyricum*. At the left, the relatively short tube and large cup of *P. maritimum*. At the top, the long tube and small cup of *P. verecundum*, to which *P. tortuosum* is very closely allied. (From B.M. and B.R.)

angled black seeds.—Species 14 or more in the Medit. region, eastward to India and southward in Afr. *Pancratiums* and *hymenocallis*, sometimes called spider-lilies or spirit-lilies, form a beautiful group of bulbs, hardy or tender, some blooming in winter, others in summer, and all characterized by the beautiful floral structure known as a staminal cup. This cup is white and has the texture of petals. It is fringed or toothed in a great variety of ways. The filaments growing out of the cup are long or short. The perianth-segms. are usually long, slender, and gracefully recurved.

The species of *pancratium*, coming as they do from Africa, southern Asia, and southern Europe, in most cases need a high temperature while in growth and a period of rest after flowering. The "rest" is secured by placing them in a house where there is plenty of ventilation and a cooler temperature. Gradually withhold water, giving only just sufficient to keep in a life-like state. The bulbs should be kept in this semi-dry state through the winter. After the middle of January, they may be repotted or have a top-dressing. For a compost, use a good strong loamy soil four parts, well-decayed cow-manure one part. When the roots get well through this compost, liquid manure will be useful once a week. Those bulbs that do not need repotting may have some of the old compost removed, but care must be taken not to injure any of the roots. They may now be placed in a house with a night temperature of 60°. As growth progresses, the temperature may be increased at night

to 65° or 70° and at day, with sun, from 80° to 85°. Keep well up to the glass so their growth will be as stocky as possible. In their growing season, they will consume large quantities of water, and they should never become entirely dry at the roots. Give plenty of syringing in bright weather, and ventilate so as to keep temperature right. When they show flower, they may be given a drier and more airy house. For a winter temperature, 50° to 55° will be high enough, with about 10° increase with sunshine.—*Pancratiums* can be increased by offsets and seed. The offsets may be separated from the parent plant and placed rather close in pans in a light mixture of equal parts of leaf-mold, peat, and sand, given good drainage. When they have made a few roots, they may be potted up into small pots and grown on. When sowing seed, prepare some pans by giving plenty of drainage and filling with a mixture of leaf-mold, peat, and sand, screening some of it fine for the top. Sprinkle the seed all over the surface and cover with the fine mixture, press firmly and give ordinary stove temperature. Maintain an even moisture with these pans. When they start to come up, place well up to the glass. When large enough, prick out into other pans or flats, using a heavier compost. Pot off when larger and grow without rest through the winter. In the spring they will require 5- or 6-inch pots. Their management from this on will be that already mentioned. Give light fumigations often in order to keep down aphids and thrips. Scale and mealy-bug, which often get into the axils of the leaves, can be removed by the use of a soft brush. (J. J. M. Farrell.)

A. *Perianth-tube* 3-6 in. long.

B. *Segms.* more than 2 in. long.

tortuosum, Herb. Bulb globose, 2 in. or less diam., with long cylindrical neck: lvs. 6-12, linear, spirally twisted, 1 ft. or less long, with the fls., the latter 2-4 in an umbel: perianth-tube 5-6 in. long, the segms. linear and ascending, greenish; staminal cup over 1 in. long, distinctly toothed between the short free tips of the filaments. Autumn and winter. Arabia and Egypt.

BB. *Segms.* 1½ in. long.

verecundum, Ait. Fig. 2741. Bulb globose, 2 in. diam., with long cylindrical neck: lvs. 6-10, sword-shaped, appearing with the fls.: peduncle compressed, 1 ft. long; fls. 2-6, white, with greenish tube, fragrant; tube 3-4 in. long; segms. linear; staminal cup or corona 1 in. or less long, bifid between the free filaments. India. B.R. 413.

AA. *Perianth-tube* 1-3 in. long.

B. *Staminal cup* small, 3-4 lines long.

illyricum, Linn. Fig. 2741. Bulb very large: lvs. 5-6, strap-shaped, glaucous, 1½-2 in. wide, appearing with the fls.: scape 1 ft. or more long; fls. white, 6-12 in a centripetal umbel; perianth-tube 1 in. long, green; segms. 1½ in. long; staminal cup with long narrow, 2-cut teeth; free portion of filaments 6-9 lines long: seeds not compressed. Summer. Corsica, Sardinia, Malta, S. Italy. B.M. 718. Gn. 48, p. 246.—Hardest, commonest and perhaps the best.

BB. *Staminal cup* large, 1 in. long.

maritimum, Linn. Figs. 2741 and 1936, Vol. III. Bulb globose, 2-3 in. diam. and with a neck: lvs. 5-6, linear, glaucous, persistent, becoming 2-2½ ft. long: fls. white, very fragrant, 5-10 in an umbel on a compressed scape or peduncle; perianth-tube 2-3 in. long; segms. linear, 1½ in. long, ascending; staminal cup very prominent, the teeth short, triangular and regular; free part of filaments 3 lines long. Spain to Syria. B.R. 161.

P. Aménas, Ker=*Hymenocallis Aménas* (see suppl. list, p. 1627).—*P. aménus*, Andr.=*H. ovata*.—*P. calathinum*, Ker=*H. calathina*.—*P. caribaeum*, Linn.=*H. caribaea*.—*P. coronarium*, Le

Conte—*H. occidentalis*.—*P. fragrans*, Salisb.—*H. ovata*, but *P. fragrans*, Willd.—*H. caribaea*.—*P. galvestonense*, Hort., presumably—*H. galvestonense*.—*P. Hdrissi*, Hort., is presumably *H. Hdrissiana*.—*P. littorale*, Jacq.—*H. littoralis*.—*P. mericdnum*—*H. rotata* probably.—*P. ovatum*, Mill.—*H. ovata*.—*P. rotatum*, Ker—*H. rotata*.—*P. undulatum*, HBK.—*H. undulata*.

WILHELM MILLER.
L. H. B.†

PANDANUS (Latinized form of a Malayan name). *Pandanaceæ*. SCREW-PINE. Tropical plants often attaining the size of trees, and remarkable for their stilt-like aerial roots, and the perfect spiral arrangement of their long sword-shaped leaves. They are planted in tropical and subtropical regions, and are also grown as pot and tub specimens for greenhouse, residence, veranda and lawn decoration, where their stiff clustered foliage gives them a formal decorative character.

The family *Pandanaceæ* comprises 3 genera (Warburg, in Engler's *Das Pflanzenreich*, IV:9 [hft. 3] 1900): *Sararanga*, with 2 species, in the S. Sea Isls. and Philippines; *Freycinetia*, more than 100 species, from Ceylon to Philippines, Austral., New Zeal., and Hawaii; *Pandanus*, with probably 250 species now described, in Trop. Afr., India, Austral., islands of the Indian Ocean and the Pacific. *Pandanus* comprises small trees or shrubs, erect or rarely prostrate, usually forked, the trunk annular, often producing aerial roots: lvs. linear and acute, commonly sharp-dentate or prickly on margin and midrib, the base usually vaginate but not petioled: fls. dioecious, in axillary or terminal spadices, the male spadices branched, the female always terminal and racemose or solitary, the leafy spadix-bracts usually colored; perianth none; stamens many in male fls., the filaments free or connate; staminodes in female fls. small or none, the ovary free or joined to those of adjacent fls.; ovule solitary and erect: fr. a syncarpium of free or connate angular woody or fleshy drupes, sometimes large (1 ft. long) and cone-like.—The screw-pines are characteristic plants in many tropical regions, with long ringed trunks, bracing roots, and crowns of dracena-like foliage. The lvs. of some species are used in manufacture of bagging and in other ways, and of some kinds the frs. are eaten. Some of them have very fragrant fls., and of others the frs. or other parts are fetid. Two species are important in cult., *P. Veitchii* and *P. utilis*, the former variegated, the latter not. (See Figs. 2742–2744.) Young plants of these are amongst the most popular foliage plants for home decoration. They are especially suited for fern-pans and table-decoration. They are grown to a very large extent by wholesale florists and palm specialists.



2742. *Pandanus Veitchii*.

Every conservatory has them, and occasionally *P. utilis* is grown to a considerable age and height for the sake of a perfect specimen of the spiral habit of growth on a large scale. (See Fig. 2743.) Some of the species have red- or purple-tinted lvs., but these appear not to have become popular. In the tropics, *P. utilis* is as valuable to the natives as many palms. The frs. are edible, and the roots furnish fiber for ropes, baskets, mats and hats, as do also the lvs. which are used in



2743. *Pandanus utilis*. A young screw-pine just beginning to show the spiral character.

making paper and nets. The numbers of species in commercial cult. are very few, although many names occur in horticultural literature. Without fls. and frs., it is difficult to know what species are actually in cult., or how accurate may be the popular descriptions and illustrations. For the same reason it is impossible to construct an accurate botanical key that will be of practical use to the gardener. Some of the good garden kinds are unplaced botanically, particularly the variegated or striped-lyd. kinds, which are sterile or the fructification insufficiently studied.

Pandanuses are among the best decorative plants and they are not difficult to manage when grown under favorable conditions. They are usually at home in palm-houses, and some of the species may be treated as semi-aquatics in victoria tanks. As a rule, they thrive in much heat and with plenty of water. From the latter part of January on, these plants become active in growth. It is at this time that one must make the atmosphere of the house more congenial in the way of supplying abundance of atmospheric moisture. To supply this condition, damp down the benches, paths and under the benches two or three times a day in bright weather. Before they have made too much headway any necessary repotting should be done, such as renewing with new compost or shifting into larger pots. A good compost to use is fibrous loam four parts, well-decayed manure and leaf-mold one part each, with enough sand added to give it a porous texture. See that the pots have plenty of drainage and pot firm enough to get the new compost well around the roots. In February and on, as the days become longer and the sun more powerful, they will require more water at the roots, with frequent syringings. The temperature may be increased from 60° to 65° at night, and in late spring and summer they will need a night temperature of 70° with a rise of 10° to 15° in bright weather. During summer when the sun is powerful, they will need a little shade, but only enough to hold them in good color as they like plenty of diffused sunlight at this

period. In autumn, winter and spring, they like plenty of sunshine. When autumn comes, do less watering and syringing, as root-action is becoming less active. To keep them in good health, it is very important to use great care in watering them in the winter months, as any unskilful or careless watering will surely cause ruin. Also give ventilation strict attention at all times. —Most of the species of pandanus can be increased from suckers, that are more or less produced from the main stem. These may be taken off and a few of the bottom leaves removed, and placed singly in small pots, using a mixture of loam, peat, and sand in equal parts. Plunge in a warm propagating-bed where they may have a brisk bottom heat. The best time to increase this stock is after January. Some species are grown from seed. Seeds may be sown whenever they can be secured fresh, which is usually in the spring. Sow the seed in pans in a mixture of loam, peat, and sand in equal parts. Cover and press firmly. Keep moist, but not in a soaked condition. It will aid the germination to soak the seed twenty-four hours in tepid water. Give plenty of heat and keep shaded and they will germinate without much trouble. When large enough, pot off and keep on shifting and grow under the above cultural directions and they will form good stocky plants. (J. J. M. Farrell).

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Baptistii, 3.	horridus, 12.	pygmaeus, 10.
Blancoi, 6.	javanicus, 2, 6.	reflexus, 14.
Boryi, 6.	laevis, 6.	Rheedii, 6.
Candelabrum, 2, and	leucacanthus, 6.	Rumphii, 6.
suppl. list.	Linnæi, 6.	Samak, 6.
caricosus, 13.	Loureiri, 6.	Sanderi, 4.
Chamissonis, 6.	mauritianus, 8.	sativus, 8.
distichus, 8.	Menziesii, 6.	spinifolius, 12.
Douglasii, 6.	Moorei, 7.	spiralis, 6.
elegantissimus, 8.	moschatus, 6.	tectorius, 6.
flabelliformis, 8.	odoratissimus, 6.	urophyllus, 12.
Forsteri, 7.	odoratus, 6.	utilis, 8.
Fosterianus, 7.	odorifer, 6.	Vandermeeschii, 15.
furcatus, 12.	ornatus, 9.	variegatus, 2.
graminifolius, 10, 11.	pacificus, 5.	Veitchii, 1.
heterocarpus, 9.		

A. Foliage striped or marked with white or yellow.

1. *Veitchii*, Hort. Fig. 2742. Lvs. 2 ft. long, broader than in the common *P. utilis*, somewhat recurved, spiny-toothed, dark green in the center, margined with broad bands of white or silvery white, the apex long-



2744. *Pandanus utilis*. Young plant of a narrow-leaved graceful form.

acuminate. Polynesia; intro. by Veitch in 1868. A.F. 4:570. F. 1871, p. 177. Gn. 2, p. 501. G. 9:176; 23:565. G.L. 26:177. Gn.W. 23, suppl. May 12. G.W. 2, p. 389; 5, p. 391; 11, p. 241; 12, p. 414.—Perhaps a form of *P. tectorius*.

2. *variegatus*, Miq. St. branched, emitting roots: lvs. narrow-lanceolate, very narrowly attenuate or even filiform above, pale green, striped or variegated with white or pale green or the younger ones all white, the prickles or spines whitish and purplish. Polynesia. —Probably plants cult. as *P. javanicus* and *P. Candelabrum* var. *variegatus* belong here.

3. *Baptistii*, Hort. A leafy short-stemmed plant: lvs. narrow, nearly 1 in. wide, curved, unarmed, long-acuminate, longitudinally lined or striped with whitish or yellowish. S. Seas, probably in New Britain Isls. R.H. 1913, p. 141. G.W. 14, p. 422. Gn.W. 9:581.—Said to be a rapid grower.

4. *Sanderi*, Hort. Habit tufted, the st. being short: lvs. 30 in. long, with minute marginal spines, not unlike those of *P. Veitchii* but of denser habit, and differing much in the variegation, which in this case is golden yellow, and in place of being confined to the margin, or nearly so, it is distributed in narrow bands of yellow and green in alternation throughout the length of its lf. Timor, Malay Archipelago. G.C. III. 23:249. R.H. 1898, p. 230. G. 21:606. Gn.W. 25:123. G.W. 11, p. 242. R.B. 24, p. 180. G.M. 41:686. A.G. 19:455; 22:189. A.F. 16:887. F.E. 13:111.—Said to be a rapid grower.

AA. Foliage green, or at least not variegated or striped.

B. Spines on lf.-margins relatively small or short (sometimes wanting).

5. *pacificus*, Hort. Lvs. broad and dark green, shining, abruptly narrowed to a tail-like apex, the margins with small fine spines. Pacific Isls. G.W. 11, p. 243; 15, p. 597.—Apparently not placed botanically, but said to be distinct and a very useful plant.

6. *tectorius*, Soland. (*P. odoratissimus*, Linn. f. *P. odoratus*, Salisb. *P. odorifer*, O. Kuntze). Height 20 and more ft., much branched, the trunk commonly flexuose and supported by aerial roots: lvs. light green, 3–5 ft. long, linear-lanceolate, abruptly produced into a long point, glaucous; spines short, white. S. Asia, islands of Indian and Pacific oceans, Austral., Philippines. G.C. III. 17:14; 32:194, 195.—A scent which is much esteemed in Java is said to be obtained from the male fls. A variable species to which many names belong, as *P. javanicus*, Hort., *P. spiralis*, R. Br., *P. Blancot*, Kunth, *P. leucacanthus*, Hort., and *P. Boryi*, *P. Chamissonis*, *P. Douglasii*, *P. Linnæi*, *P. Loureiri*, *P. Menziesii*, *P. Rheedii*, *P. Rumphii*, Gaud. Var. *laevis*, Warb. (*P. laevis*, Kunth. *P. moschatus*, Miq.), has somewhat glaucous and unarmed lvs. 6 ft. or more long, with a very long-acuminate apex. Var. *Samak*, Warb. (*P. Samak*, Hassk.), has narrow subulate-acuminate lvs., with margins and keel bearing slender whitish spines. *P. tectorius* is common in the Philippines near the sea and along tidal streams, and horticultural varieties are cult. in Manila.

7. *Försteri*, Moore and Muell. (*P. Fosterianus*, Hort. *P. Modrei*, F. Muell.). Habit of *P. tectorius*: tall, to 30 ft., branched at top, with aerial roots: lvs. to 3 ft. long and 2 in. or more wide, short-appressed-spinulose. Lord Howe's Isl.

8. *utilis*, Bory (*P. distichus*, Hort. *P. flabelliformis*, Carr. *P. mauritianus*, Hort. *P. sativus*, Thouars). Figs. 2743–2745. The best-known species: attains 60 ft. in Madagascar, where it is native: branching: lvs. glaucous, erect, 1–2½ ft. long, 3 in. wide, spines red. I.H. 7:265. B.M. 5014 (as *P. Candelabrum*). R.H. 1866: 270. A.F. 4:571. F.E. 15:592. G.W. 15, p. 597.—Cult. in tropics; lvs. used in making of bags, baskets,

mats, and other articles. Juvenile specimens with curving lvs. $1\frac{1}{2}$ ft. or less long, may be known as *P. elegantissimus* or by other names.

9. *heterocarpus*, Balf. f. (*P. ornatus*, Bull). Branching tree, to 20 ft., with slender trunk, very numerous roots and spreading branches: lvs. lanceolate-acuminate, dilated and clasping at the base, erect-spreading, leathery, strict, greenish, often somewhat glaucous at the base, rather flat margin covered with small red,



2745. *Pandanus utilis*. An old screw-pine in the tropics. (Adapted from "The Garden")

slightly incurved spines; lower midrib furnished from the middle with distant spines of the same character. Mascarene Isls. I.H. 19:97.

10. *pygmaeus*, Thouars. Low spreading shrub, not over 2 ft. high in the center, but sending out from the base numerous horizontal, rooting, annulated branches: lvs. about $1-1\frac{1}{2}$ ft. long, spirally arranged in 3's, linear-subulate, with a clasping base; margins and keels fringed with small fuscous spines. Madagascar. B.M. 4736.—Said sometimes to be cult. as *P. graminifolius*.

11. *graminifolius*, Kurz. Lvs. 12-18 in. long by 3-4 lines wide, glaucous beneath; marginal and carinal spines minute, straight. Burma, and the true species perhaps not cult.; see No. 10. *P. graminifolius* of the trade has never been carefully distinguished from *P. pygmaeus*, and, according to Nicholson the garden plant under this name is a species of Freycinetia. F.R. 2:388, where Taplin says it has a tufted much-branched habit, dark green lvs. about $\frac{1}{2}$ in. wide, not so stiff as most species; spines short, whitish. Gn.W. 20:446. G.W. 11, p. 245.

12. *furcatus*, Roxbg. (*P. horridus*, Blume. *P. spinifolius*, Dennst. *P. urophyllus*, Hance). Tree, attaining 30-40 ft., branched, with aerial roots at base: lvs. very long, attaining 6-9 ft., about 3 in. wide, somewhat glaucous beneath, the margins and keel with distantly thick spines; apex long-acuminate. India. R.H. 1879:290; 1881, pp. 174, 175.

13. *caricoides*, Kurz. Low, caespitose: lvs. 5-8 ft. by about 2 in., glaucous beneath; margins and dorsal costae densely spinulose-serrate, the spines very small and acute. Java. R.H. 1878, p. 405.

BB. *Spines disagreeably long.*

14. *reflexus*, C. Koch. Tree, about 15 ft., branched, the trunk 3-6 ft. tall: lvs. reflexed, acute, 5-6 ft. long, dark green, shining; spines long, whitish, those on the midrib of the lower side reversed. E. African Isls. F.R. 2:387. G.W. 11, p. 245.

15. *Vandermoeschii*, Balf. f. Tree, to 20 ft., much branched: lvs. stiff, suberect, $2\frac{1}{2}$ -3 ft. long, $1\frac{1}{2}$ -2 in. broad, very glaucous; margins red and thickened; spines strong, red; midrib red, prominent, spiny. Mauritius. G.C. III. 18:237.

P. amaryllifolius, Roxbg. Plant small and diffuse, supported by aerial roots: lvs. linear, somewhat 3-nerved, the apex somewhat dilated, little spinose-serrate. Probably Malayan. C.L.A. 19:131. G.W. 11, p. 245.—*P. Budgei*, Wildem. Lvs. rather broad, robust, with sharp claw-like prickles on margins and keel, said to be a beautiful decorative plant. Congo.—*P. Candelabrum*, Beauv. CANDELABRUM TREE. CHANDELIER TREE. Tree, attaining 30 ft., the lower branches horizontal and upper erect; lvs. 3 ft. by 2 in., dark green and glaucous, strongly toothed; spines brown. Trop. Afr. B.M. 5014, under this name is *P. utilis*.—Not advertised in Amer. but for the popular variegated form, see No. 2.—*P. Houletii*, Carr. Height 7-8 ft. in the wild, simple, with aerial roots: lvs. many, the blades linear and gradually acuminate-pointed, sometimes 8 ft. long and 4 in. broad, with small curved brown or purplish spines, surface dark green, tinged copper-red, or young ones purple. Singapore. B.M. 8197. R.H. 1868, p. 210.—*P. luzonensis*, Merrill. Probably the species reported in S. Fla. as *P. luzonicus*: tree, 25 ft., with erect trunk much branched above: lvs. to 6 ft. long and about 1 in. wide, long and narrow-acuminate, the margins strongly antrorsely toothed, and with stout curved spines. Philippines.—*P. nitidus*, Kurz.—*P. stenophyllus*, Kurz. Shrub, 6-8 ft., with many prop-roots: lvs. 2-3 ft. or more long, 1 in. wide, shining, the margin and keel remotely pale, spinulose-serrate. Java. G.W. 11, p. 242.—*P. Warrinidius*, Hort. Lvs. narrow, strap-shaped, recurved, dark olive-green, with irregular awl-shaped teeth. Habitat unrecorded. L. H. B.†

PANDOREA (*Pandora*, Greek mythological name). *Bignoniaceae*. Ornamental woody vines grown for their beautiful flowers and also for their handsome foliage.

Evergreen shrubs, climbing without tendrils or roots: lvs. opposite, odd-pinnate; lfts. entire or serrate; fls. in axillary or terminal few- or many-fl. panicles; calyx small, campanulate, 5-toothed; corolla funnel-form-campanulate, with imbricate lobes; stamens included, with spreading superposed anther-cells; disk thick, ring-like; ovary linear, the seeds in many series: pod oblong, with thick not keeled valves; seeds broadly elliptic, winged.—Five species from Austral. to Malay Archipelago and in S. Afr. Formerly usually included under *Tecoma*.

The pandoreas are vigorous-growing vines or lianas with handsome evergreen foliage and beautiful white or pink rather large flowers. They can be grown outdoors only in the southern states and in California and stand few degrees of frost; in the North they are sometimes cultivated in the greenhouse. They require rich soil and sunny position. Propagation is by seeds and by greenwood cuttings under glass. See also *Bignonia* for culture.

The wonga-wonga vine, *P. australis*, is rather difficult to grow on high pine-land, as it needs a soil rich in humus. In rich soil, however, and liberally fertilized, it is a rampant grower with beautiful dark green glossy foliage. The flowers are interesting but comparatively small, and not showy. However, the species is worth cultivating for foliage alone. It must be well taken care of and well watered during the dry spring months or it will dwindle away in a very short time.

P. Ricasoliana, from Natal and Caffraria, demands a very rich soil and a heavy mulch of stable manure. Its leaves easily drop from the woody branches after a cold night, and 6° or 7° of frost kill the plant down to the ground. For this reason the vine should be banked with dry sand every fall and if killed down to the banking it must be cut off immediately or the entire plant will be lost. Plants raised from seed received under the name of *Tecoma Ricasoliana*, from Italy, are much hardier and more floriferous than those obtained from seed imported from South Africa, but the flowers of both are exactly alike. In order to flower profusely,

this species must be planted in the full sun. It usually requires a few years before it starts into a vigorous growth, and it rarely flowers before its fifth year or before it has attained considerable size. In Florida, *P. Ricasoliana* should be planted on tall stumps, or on arbors and sheds by itself, never mingled with other species. (H. Nehrling.)

A. Fls. white: lfts. 3-9.

australis, Spach (*Bignonia Pandoræ*, Sims. *Tecoma australis*, R. Br.). WONGA-WONGA VINE. Evergreen high-climbing shrub: lvs. odd-pinnate; lfts. 3-9, elliptic-ovate to ovate-lanceolate, acuminate but bluntly pointed, entire or sometimes coarsely crenate, shining above, glabrous, 1-2½ in. long; panicles many-flid.; corolla funnelform-campanulate, with 5-lobed spreading limb, yellowish white, spotted violet in the throat, ¾ in. long; fr. oblong, pointed, 2-3 in. long. Spring. Austral. B.M. 865. Gn. 27, p. 94. Var. *rosea*, Hort. Fls. light rose-colored. —“Young plants and particularly seedlings have the lvs. very finely cut, nearly of the appearance of a fern and are in this stage sometimes known as *Tecoma filicifolium* or *Campsidium filicifolium*; when getting older they change entirely.”—Franceschi.

jasminoides, Schumann (*Tecoma jasminoides*, Lindl. *Bignonia jasminoides*, Hort.). BOWER PLANT OF AUSTRALIA. Evergreen climbing shrub: lvs. odd-pinnate; lfts. 5-9, almost sessile, ovate to lanceolate, acuminate, but bluntly pointed, entire, glabrous, 1-2 in. long; panicles rather few-flid.; corolla funnelform-campanulate, the large spreading 5-lobed limb with crenate lobes, white, sometimes suffused with pink, usually rosy pink in the throat, 1¼-2 in. long; calyx small, 5-lobed. Aug.-Oct. B.R. 2002. B.M. 4004. P.M. 6:199. R.H. 1895, p. 109. Var. *alba*, Hort., has larger white fls.

AA. Fls. pink: lfts. 7-11.

Ricasoliana, Baill. (*Tecoma Mackénii*, W. Wats. *Tecoma Ricasoliana*, Tanfani). Evergreen climbing shrub: lvs. odd-pinnate; lfts. 7-11, short-stalked, elliptic-ovate, acute or acuminate, serrate, dark green above, pale beneath, glabrous, about 1 in. long; fls. in loose, terminal panicles; corolla funnelform-campanulate, with spreading 5-lobed limb, light pink, striped red, glabrous inside and outside, 2 in. long; calyx 5-toothed; fr. linear, terete, 10-12 in. long. S. Afr. G.W. 2:343, 346. J.H.S. 39, p. 12, fig. 15.

Brjcei, Rehd. (*Tecoma Brjcei*, N. E. Br. *Tecoma Regina Sabæ*, Franceschi). Evergreen climbing shrub: lfts. 9-11, stalked, lanceolate, acuminate, entire, glabrous, 1-2 in. long; fls. in large terminal panicles, slen-



2746. *Panicum virgatum*.

PANICUM

der-pedicelled; calyx glandular; corolla funnelform-campanulate, abruptly contracted at the base, light pink, netted with crimson, yellow in throat, tube 1¼ in. long, hairy inside, limb spreading, about 2 in. across. Oct.-March. Rhodesia. G.C. III. 39:344.

ALFRED REHDER.

PANICULARIA: *Glyceria*.

PANICUM (old Latin name of Italian millet, *Setaria italica*). Gramineæ. Annual or perennial grasses with usually flat blades and paniculate inflorescence.

Spikelets with 1 terminal perfect floret and below this a second floret which may be staminate, neutral or reduced to the sterile lemma; fertile lemma characterized by being of a much firmer texture.—An immense genus of grasses scattered over the world, especially in the tropics. Several hundred species have been described, while conservative authorities place the number at about 300. Their importance as forage grasses is very insignificant when the number of species is taken into consideration. This is largely from the fact that the species, as a rule, are not gregarious, and to the fact that they are not well represented in the meadows and prairies of temperate and northern regions. Guinea-grass and para-grass are, however, important forage grasses of the warmer regions.

A. Plant annual.

capillare, Linn. OLD WITCH-GRASS. A common native annual grass and weed, has been recommended for cult. on account of its ornamental purple panicle, which is ample and loose, the spikelets being borne on slender hair-like pedicels. R.H. 1890, p. 525; 1896, p. 572. Dept. Agric., Div. Agrost. Bull. 17:54.

miliaceum, Linn. TRUE MILLET. BROOM-CORN MILLET. HOG MILLET. A tall annual (3-4 ft.), with soft lvs., grown for fodder, but not in common use in this country: spikelets large, in a rather compact drooping panicle. Dept. Agric., Div. Agrost., Bull. 20:37.—Cult. from prehistoric times. Grown somewhat extensively in China and Japan, and S. E. Russia. Native country unknown, but probably E. Indies. More fully discussed in Dept. Agric., Farmers' Bull. No. 101. What is usually grown in the U. S. under the name of millet is *Setaria italica* and its varieties.

texanum, Buckl. COLORADO-GRASS. TEXAS MILLET. Commonly decumbent at base and rooting at the lower joints: culms stout, 2-6 ft.; foliage softly hairy: panicle narrow, the large, pointed, hairy spikelets somewhat crowded: seed cross-wrinkled. Dept. Agric., Div. Agrost., Bull. 7:50.—The common name refers to the Colorado River of Texas where the species is native. Sparingly cult. in the southern states.

AA. Plant perennial.

B. Blades long and narrow, not plicate.

virgatum, Linn. Fig. 2746. An upright grass with stiff culms, 2-6 ft. high, and with stout scaly rootstocks: spikelets in loose, compound panicles, usually more or less purplish, sharp-pointed; first glume half as long as spikelets, 5-7-nerved, second glume and sterile lemma of about equal length, 5-7-nerved. Native throughout U. S. except in the extreme W. R.H. 1890, p. 525; 1896, p. 572. Gn. 14, p. 215; 29, p. 235; 37, p. 245. G. 10:103. Dept. Agric., Div. Agrost. Bull. 7:60. A hardy perennial used for ornamental purposes.

maximum, Jacq. GUINEA-GRASS. Four to 8 ft., or sometimes taller, forming dense tufts: culms robust: nodes hairy: sheaths more or less hirsute; blades 20-30 in. long; panicle 1-2 ft. long, the long stiff branches arranged in whorls; spikelets short-pedicelled, smooth,

rather glossy, the seed minutely cross-wrinkled. Native of Afr., early intro. into the W. Indies and Trop. Amer.—Cult. for forage in the Gulf States.

barbinode, Trin. (*P. molle* of authors, not Swartz). **PARA-GRASS**. Strongly stoloniferous, as much as 20 ft. long: culms decumbent, rooting at the joints, 6–10 ft. high, robust: sheaths more or less hairy, the blades smooth, 6–20 in. long: panicles 8–15 in. long, consisting of numerous ascending racemes with rather crowded spikelets.—Intro. from Brazil. *P. numidianum*, Lam., is a closely related species of the E. Indies, sometimes confused with true para-grass.

BB. Blades an inch or more broad, plicate: panicle narrow, the spikelets interspersed with bristles.

sulcatum, Aubl. A tall perennial, 4–6 ft., native of Trop. Amer.: lvs. large, 1 in. or more broad, somewhat hairy, conspicuously plicate: panicle narrow, about 1 ft. long, with many ascending branches, bearing short-pedicelled spikelets throughout their length, and also scattered bristles; spikelets pointed; lower glume half, second glume two-thirds the length of the sterile lemma and fertile floret, all strongly nerved.—This and the next species belong to the section *Ptychophyllum*, which is better referred to *Setaria*.

palmifolium, Willd. (*P. plicatum* of authors, not Lam.). **PALM-GRASS**. Fig. 2747. Resembles the preceding, but lvs. broader and nearly smooth, the panicle larger and more bristly: spikelets similar. G. 3:101. Gn. 12, p. 517; 31, p. 487; 37, p. 245. R.H. 1862, p. 290.—A variegated form is figured in F.S. 17:1743–44 under the name *P. foliis niveo-vittatis*. Cult. in the S. for ornament. Native of E. Indies. Woolson, of Passaic, N. J., says it grows 4–6 ft. high in the hardy border and makes a fine, stately grass; useful for winter bouquets. This grass is known in the trade as *P. plicatum* or less commonly as *P. excurrens*, but the real *P. plicatum*, Lam., through an allied species, is a smaller, narrower-lvd. plant of no particular beauty and unknown in cult. The true *P. excurrens*—*P. plicatum*, Lam.

P. atrosanguineum of lists is apparently *Pennisetum Ruppellii*.—*P. Crus-galli*=*Echinochloa*.—*P. frumentaceum*=*Echinochloa*.—*P. germanicum*=*Setaria*.—*P. variegatum*=*Oplismenus Burmannii*.

A. S. HITCHCOCK.

PANÍSEA (Greek, *entirely like*, referring to the fact that the labellum is like the other floral parts). *Orchidaceae*. Epiphytic herbs, densely caespitose: sepals and petals somewhat similar, narrow, free; labellum narrow, with a long sigmoid-flexuous claw; column slender, broad-winged above; pollinia 4, almost without appendages.—About 4 species in the Himalayas and Assam. *P. tricallosa*, Rolfe, having pale translucent yellowish green fls.; with 3 yellow calli on the disk tipped with brown, has been grown in botanic gardens. Assam.

PANSY. A favorite garden perennial, commonly grown as an annual; prized for the beauty and individuality of its flowers. The pansy is everywhere a familiar flower. There is much character in it. The flower is often likened to a face. It appeals to personal feeling. In fact, the word pansy is only a corruption of

the French *pensee*, meaning thought. The old folk-name, heartsease, is also associated with the familiar place which the plant has occupied; it signifies remembrance. The pansy is one of the oldest of garden flowers. Parkinson mentions it as a flower-garden subject in 1629. When critical study began to be given to the kinds of plants, the pansy was so distinct from wild species that its specific identity could not be determined with precision, and, in fact, this is the case to the present day. It is generally considered, however, that it has descended from *Viola tricolor* (see *Viola*), a small perennial violet native to the cooler parts of

Europe. In its nearly normal or unimproved forms, *Viola tricolor* is now grown in gardens. (Fig. 2748.) It is a most interesting plant, because handsome-flowered and variable. The flowers of this violet usually have three colors or shades, mostly blue, whitish and yellow, but in the different varieties one of the colors strongly predominates. A form with very small and inconspicuous flowers (var. *arvensis*) has run wild in many parts of the country.

Pansies are perennial, but they are grown practically as winter or spring annuals. Commercial growers sow the seeds in fall, and sell great quantities of the seedling plants before winter sets in. These plants are flowered in frames or cold greenhouses, or they are planted in the open for spring bloom. Plants are also started indoors in late winter for spring bloom. Pansies delight in cool, moist weather; hence the American summer is not to their liking, and they often perish. A new stock of plants is started every year.

The modern improved pansies run in strains or families rather than in definite varieties. These strains are maintained at a high grade by the best cultivation and the closest attention to selection. The seed of the best strains is necessarily expensive, for it represents much human care. The stock usually runs down quickly in other hands. It should be renewed from the seed-breeder each year if the best results are to be maintained. These fancy and high-bred strains require extra care in the growing. Most of the best strains are of European origin. They are usually known by the name of the breeder. The chief points of merit in the high-bred pansy are size of flower, brilliancy of coloring, arrangement of colors. The flowers may be self-colored (of only one color) or parti-

colored. The parti-colored flowers are of three general types: two banner petals and three central petals of different colors; petals all margined with lighter color; petals all striped. There are all grades of intermediate differences. The colors which are now found in pansies are pure white, purple-black, pure yellow, different shades of blue, purple, violet, red-purple. Pansy flowers are now grown 3 inches across. (Fig. 2749.)

With the above account may be compared Gerard's description of pansies in 1587. He pictures the heartsease or *Viola tricolor* with small violet-like flowers, the petals standing apart from each other. The "upright heartsease," or *Viola assurgens tricolor*, is represented as a stouter and more erect plant, with rounder but scarcely larger flowers. These are described as follows:



2747. *Panicum palmifolium*.

"The Hearts-ease or Pansie hath many round leaves at the first coming up; afterward they grow somewhat longer, slightly cut about the edges, trailing or creeping upon the ground: the stalks are weak and tender, whereupon grow floures in form & figure like the Violet, and for the most



2748. *Viola tricolor*. Nearly or quite the original form of pansy.

part of the same bignesse, of three sundry colours, whereof it tooke the syrnyme *Tricolor*, that is to say, purple, yellow, and white or blew; by reason of the beauty and braverie of which colours they are very pleasing to the eye, for smel they have little or none at all. The seed is contained in little knaps of the bignesse of a Tare, which come forth after the floures be fallen, and do open

of themselves when the seed is ripe. The root is nothing else but as it were a bundle of threddy strings.

"The upright Pansie bringeth forth long leaves deeply cut in the edges, sharp-pointed, of a bleake or pale green colour, set upon slender upright stalks, cornered, jointed, or kneed a foot high or higher; whereupon grow very faire floures of three colours, viz., of purple, blew, and yellow, in shape like the common Hearts-ease, but greater and fairer; which colours are so excellently and orderly placed, that they bring great delight to the beholders, though they have little or no smel at all: for oftentimes it hapneth that the uppermost floures are differing from those that grow upon the middle of the plant, and those vary from the lowermost, as Nature list to dally with things of such beauty."

L. H. B.

Cultivation of pansies.

There are few plants more popular than the pansy. Every year the demand for the plants is greater. This flower has been cultivated for so long that its source is a matter of uncertainty. As seen at the present day, it is an artificial production, differing considerably from any known wild plant.

Pansies were probably first improved from the original type in Great Britain, where the cool and moist climate is well adapted to their cultivation, and new varieties gradually appeared with larger flowers, of varied colors. For many years, England and Scotland bore the reputation of growing the best pansies. About forty years ago, three French specialists, Bugnot of St. Brieuc, and Cassier and Trimardeau of Paris, made immense strides in developing the pansy, and their productions were a revelation to the horticultural world. Such sizes and colors were previously thought impossible. Trimardeau developed a new race with immense flowers and very hardy constitution. His strain, crossed with those of Cassier and Bugnot, has given a pansy which is superseding the older English varieties. At the present day, Germany and France lead in introducing new varieties.

It is customary at the present day to make a careful selection of seedlings for new varieties, also to propagate by the means of cuttings. The specialists are devoting much time to the improvement of the various types and strains. The flowers are being steadily improved in all points by which pansies are judged,—size, color, substance and form. Nearly all of the beautiful colors are to be found among the giant types, and the care that is being taken in the

selection of colors makes it reasonably sure that, when the choicest seed is obtained, a large percentage of the plants will come true to color. The season of blossoming has been extended, the new early-flowering strains blooming five or six weeks earlier in the spring than the old varieties.

There are many beautiful varieties of pansies and it is difficult to make a selection, but the most popular for both amateur and commercial growers are the giant flowers of the Trimardeau type, the Cassier superb strain of blotched pansies, and the Bugnots. One of the newer strains is the "Masterpiece," a very large flower with curled or ruffled petals, which are so undulated and curled that many of its blossoms appear to be double. The new upright giant five-blotched pansy called the "Princess" by Ernest Benary is entirely distinct from all other pansy strains in its great compactness, its upright growth and its hardness. Two other types which should be mentioned are the "Orchid Flowered," whose delicate orchid colors do not exist in any other strain; and the "New Early Flowering Giant" pansy, which blossoms in early March.

It is conceded by European pansy specialists who have visited the United States that the American pansy seed planted on the American soil, will produce larger and finer flowers than the foreign-grown seed of the same strain planted on the same soil.

Pansies degenerate very quickly; therefore it is very important to procure fresh seed every year from a specialist.

The four characteristics of the pansy required by the four leading pansy-growing people are as follows:

Germany: Color, substance, form, size.

Great Britain: Form, color, substance, size.

France: Substance, size, color, form.

America: Size, color, substance, form.

The success of growing a crop of pansies depends largely on having good fresh seed and on how the seed-bed is treated the first six to twelve days; for if pansy seed becomes dry after once sprouting, it is dead; and if kept too close, it will damp-off.

A coldframe is a good place in which to sow the seeds if the boards are not full of fungus; or a box 9



2749. Modern pansies. (Nearly $\frac{1}{2}$ natural size)

inches to a foot high might be made on fresh ground that is a little sandy and was well manured for a previous crop; dig and make the soil fine and water it well before sowing the seeds. Sow in drills 3 inches apart and $\frac{1}{4}$ inch deep. One ounce of seed will sow about 300 to 350 feet of drill, or 90 feet if sown broadcast. Cover the seed $\frac{1}{4}$ inch deep with fresh sand or sandy soil, pat down or roll well and give a light watering. The surface should be dusted with sulfur or grape dust to keep the damping-off fungus from starting. Cover with boards, leaving space for ventilation; or they can be covered with moss, hay, or straw, being sure to remove the covering as soon as the seed is sprouted. Pansy seed will not sprout well if kept above 75°. After sprouting and until they have the second leaves, it is a good plan to cover them with the thinnest muslin, tacked on frames. Sashes may be used if well shaded and well ventilated.

To secure the best results, pansy seed should be sown from July 10 to August 25. If plants for cut-flowers are wanted, sow the seed the first part of July. The best plants for wintering over in the field for spring sales are from seeds sown from July 10 to 20 in the northeastern states. Five or six weeks after sowing the seeds, the plants are usually large enough to be transplanted in the field, in good rich ground. The soil can hardly be made too rich, and should be in raised beds so the water will not stand on them in the winter. Plant 7 or 8 inches apart each way. If a coldframe is used, from 50 to 250 plants can be set under a 3- by 6-foot sash. If pansy plants are transplanted the first time into the place where they are wanted to grow, they will have larger flowers; for every time the roots of a pansy are disturbed, the flowers will be smaller. Just enough mulch should be applied to hide the plants from view after the ground is frozen. This mulch is taken off as soon as the frost is out of the ground in the spring.

There are from 25,000 to 28,000 seeds in one ounce of pansy seed. Growers usually allow one ounce of seed for 4,000 plants. With good fresh seed and great care, 7,000 to 8,000 plants should be obtained from one ounce of seed. For commercial purposes, pansy seed should be planted in July and August, but at this time of the year, it is too hot for the seeds to grow well. Seeds planted in the fall or early spring will give double the number of plants and require less care.

If pansies for winter blooming are desired, transplant as soon as the plants are large enough to the beds or benches in the greenhouses. They will need about the same temperature as for violets, 40° to 45° at night, and 60° in the daytime in bright weather.

Pansies are now being grown very extensively for cut-flowers in this country.

If wanted for exhibition purposes, keep the pansy plants in a low temperature till January; some freezing, even, will benefit them. Start them slowly into growth at a temperature between 30° to 40° at night, as a higher temperature will diminish the size of the flowers. A weak solution of guano or hen-manure once every two weeks will help them wonderfully. During growth and bloom, maintain a rather low, even temperature, without actual freezing, carefully avoiding extremes in temperature.

In favored localities pansies designed for early spring bloom receive no glass protection during winter, the plants from the August sowing being transplanted in the fall from the seed-bed directly into their permanent quarters. Good pansies can be grown out-of-doors without glass protection as far north as Nova Scotia. Generally, however, it is much better to winter pansies in a coldframe, especially the finer strains. Pansies in bloom should be partially shaded from the hot midday sun, particularly the fancy-colored strains, the petals of which are more delicate in texture.

CHARLES FROST.†

PAPÁVER (old Latin name, from the Greek, of dubious derivation). *Papaveraceæ*. POPPY. Well-known flower-garden plants, of brilliant but short-lived bloom.

Herbs or rarely subshrubs, annual, biennial and perennial, with milky juice, bristly or smooth and often glaucous: lvs. usually lobed or dissected in a pinnate way: peduncles long, single-fl'd., the bud usually nodding: fls. red, violet, yellow and white; sepals 2; petals usually 1; stamens numerous: ovary and caps. globose, obovate or top-shaped, dehiscing under the vertex by transverse pores between the placentæ, the

openings very small and valve-like; this vertex or flattened sometimes conical top or cap represents the combined radiate stigmas; placentæ 4-20, projecting into the center.—Species more than 100, largely in the Medit. region, and the Armenian-Persian region and somewhat eastward, with one in the southern hemisphere; Fedde accepted 99 species in 1909 in Engler's *Das Pflanzenreich*, hft. 40 (iv:104) together with many botanical varieties and hybrids. Two or three species are indigenous in W. N. Amer. Opium is made from the milky juice of *P. somniferum*, which oozes from shallow cuts made in the young capsules. The seeds have no narcotic properties and are sold for bird food under the name of "maw seed." They also produce a valuable oil.



2750. Shirley poppy.—One of the forms of *Papaver Rhœas*.

Poppies rank among the most popular flowers in cultivation. From their astonishing range of color, and from the formidable list of names given below, one might suppose their botany to be very complicated. It is, however, easy to understand, although the variation in some of the species is very great. There are only four species commonly cultivated and these are all remarkably distinct. They are (1) the opium poppy, (2) the corn poppy, (3) the Iceland poppy, and (4) the oriental poppy.

1. The opium poppy, *P. somniferum*, is one of the commonest and the most variable. It is annual, of tall stately habit, and recognized at once by the glaucous hue of its foliage. The flowers are the largest of any of the annual species, but unfortunately they are useless as cut-flowers because they drop their petals so quickly.

2. The corn poppy of Europe, *P. Rhœas*, is also an annual, but a dwarfer plant, with green hairy finely

cut foliage and smaller flowers. It is brilliant in the fields of Europe, and it has run wild in this country. The Shirley poppies are the best strain of this species; in gardens the flowers last longer than the common *P. Rhæas* and the plants are neater when out of bloom.

3. The Iceland poppy, *P. nudicaule*, is the glory of the arctic regions. It ranges over an immense territory and varies remarkably both in the wild and the garden. Orange, red, and white are the chief colors, besides shades of yellow, but the flowers never attain the brilliant scarlet of the corn poppy. Although the Iceland poppy is perennial, it is short-lived, and is commonly treated as an annual or as a short-lived perennial. It is known for the satiny texture and crimped character of its petals. The flowers are excellent for cutting, especially if the young flowers are chosen and cut in the early morning, a principle which applies to many flowers often supposed to be useless for home decoration.

4. The oriental poppy, *P. orientale*, is a longer-lived perennial, and although it has the largest flowers of any species in the genus it has nothing like the fame of the opium poppy. However, it has the double advantage of being easily propagated by either seed or division, and it has a considerable range of color, which is said to be largely due to crosses with *P. bracteatum*. The latter differs in having large bracts below the flower.

The other species of poppy are for the fancier. The alpine poppy, *P. alpinum*, was considered by Linnæus to be a distinct species from the Iceland poppy. However, gradations occur between the typical form of *P. nudicaule* of the arctic regions and the poppy found in the Alps. The former has a yellow flower, while the common alpine poppy is white. The alpine poppy is by some regarded as an extreme form of *P. nudicaule*, characterized by a dwarfer habit and more finely divided foliage. For horticultural purposes *P. nudicaule* and *P. alpinum* should be considered to be distinct species, as many botanists indeed consider them to be. The Iceland poppy can be easily grown in the border, while the alpine poppy demands rock-garden treatment. The former does best in a moderately rich and light loam, while the latter does better in a rather poor soil. Both need full exposure to the sun, and *P. alpinum* probably needs better drainage. See No. 20, p. 2459.

The Shirley poppies are now the prevailing forms of *P. Rhæas*. The following history of the remarkable race is given by the Rev. W. Wilks in "The Garden," 57, page 385: "In 1880 I noticed in a waste corner of my garden abutting on the fields a patch of the common wild field poppy (*Papaver Rhæas*), one solitary flower of which had a very narrow edge of white. This one flower I marked and saved the seed of it alone. Next year, out of perhaps two hundred plants I had four or five on which all the flowers were edged. The best of these were marked and the seed saved, and so for several years, the flowers all the while getting a larger infusion of white to tone down the red until they arrived at quite pale pink and one plant absolutely pure white. I then set myself to change the black central portions of the flowers from black to yellow or white, and having at last fixed a strain with petals varying in color from the brightest scarlet to pure white, with all shades of pink between and all varieties of flakes and edged flowers also, but all having yellow or white stamens, anthers and pollen, and a white base." . . . Mr. Wilks then distributed it freely to all. "My ideal," he continues, "is to get a yellow *P. Rhæas*, and I have already obtained many distinct shades of salmon. The Shirley poppies have thus been obtained simply by selection and elimination. . . . Let it be noticed that true Shirley poppies (1) are single, (2) always have a white base with (3) yellow or white stamens, anthers and pollen, (4) never have the smallest particle of black about them. Double poppies and poppies with black centers may be greatly admired by some, but they

are not Shirley poppies. It is rather interesting to reflect that the gardens of the whole world—rich man's and poor man's alike—are today furnished with poppies which are the direct descendants of one single capsule of seed raised in the garden of the Shirley Vicarage so lately as August, 1880."

Hybrids between different species of *Papaver* are described in the monographs, but they do not appear to have given leading forms for cultivation. Hybrids have been produced between the annual and perennial species. Between the different garden varieties, crossing probably goes on continuously, and new strains are constantly arising.

For garden purposes most poppies are to be treated as annuals for best results, with the exception of *P. orientale* and *P. bracteatum*, which the gardener thinks of as one group. The oriental poppy is, in fact, the only common long-lived perennial poppy. The Iceland poppy may live for several years, but after the third year it usually degenerates. It blooms the first year from seed and the best results are usually secured the second year. The cultivation of poppies is very simple, except of course in the case of alpine species, for which special conditions must be provided. Seeds usually germinate readily, but as the young plants of the annual kinds do not transplant well, the seeds should be sown where the plants are to remain. In the Shirley and similar poppies, the plants may be thinned to stand 4 to 6 inches apart. For especially large and fine blooms, the plants should be given at least twice more room. A succession in sowings will provide a greatly extended season of bloom; removing the seed-pods will also extend the blooming-time. Open warm soil in a sunny exposure is preferred for poppies.

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A. Plant prickly: caps. glabrous.

1. *aculeatum*, Thunb. (*P. gariëpinum*, Burch. *P. horridum*, DC.). Annual, 1-4 ft. high, the st. nearly simple: st. branched, densely covered with spreading, rigid, unequal bristles: lvs. green, sinuately pinnatifid, the lacinations spine-tipped: fls. scarcely 2 in. across; petals scarlet-orange, unspotted: caps. glabrous, oblong-obovate. S. Afr., Austral. B.M. 3623.—The only poppy known to inhabit the southern hemisphere. Annual in S. Afr., but said to be biennial in northern botanic gardens.

AA. Plant pilose or setulose (not prickly), sometimes glabrous.

B. Species usually annual or biennial (Nos. 1-12).

C. *Herbage setulose (or perhaps glabrous in No. 2 and in forms of No. 4) green or glaucous: foliage always incised or pinnatifid, the st.-lvs. not clasping.*

D. St. elongated and leafy.

E. Caps. usually glabrous.

F. Shape of caps. club-shaped to top-shaped.

2. *californicum*, Gray. Annual, sparsely pilose-pubescent to glabrous, 1-2 ft. high: lvs. pinnately parted or

divided into toothed or 3-lobed or entire segms.: fls. 2 in. across; petals brick-red, with a green spot at the base bordered with rose-red: caps. between club- and top-shaped, flat on top, the disk 6-11-nerved. Santa Ines Mountains and southward in Calif.; also Mt. Tamalpais (near San Francisco).

FF. Shape of caps. mostly obovate or oblong.

3. *arenarium*, Bieb. Annual, 12-20 in. high, from a perpendicular root, erect, sparingly beset with bristles which are spreading on the st. and appressed on the foliage: lvs. twice pinnatisect into minute linear or linear-oblong segms.: bud obovoid or narrow-obovoid: fls. purple, with a dark spot at the base of



each petal; filaments not dilated: caps. obovate to oblong or top-shaped, with a convex disk; stigmatic rays 7-9. Sandy places in Caucasus and Caspian region.

4. *dubium*, Linn. Erect usually robust annual, hirsute, 1-2 ft. high, branched, few-flid.: lvs. glaucescent, more or less appressed setulose or often nearly glabrous above, the lower ones pinnatifid or nearly so with the segms. pinnately cut and lobes ovate or roundish or sometimes much narrower; st.-lvs. usually pinnatifid with narrow acute lobes: peduncle long; fls. pale rose, vermilion or seldom white, mostly darker in center; petals suborbicular, nearly 1 in. long; anthers violet and filaments red: caps. glabrous, obovate-oblong or oblong-clavate. Eu., N. Afr.; run wild in parts of N. Amer. Very variable, and probably little known in gardens. Var. *laevigatum*, Elk. (*P. laevigatum*, Bieb.). Glabrous or with a few small bristles: fls. purple, usually spotted; petals small, obovate: caps. narrowly top-shaped or club-shaped; stigmatic rays 8-10. Medit. to extratropical Himalaya.—It is doubtful whether the plant sold under this name is true, for in G.C. III. 5:21 it is shown with large, roundish, overlapping petals.

FFF. Shape of caps. globose.

5. *Rhæas*, Linn. CORN POPPY. Fig. 2750. Hispid annual, or rarely glabrescent, erect and branching, 1 to about 3 ft.: lvs. coarsely toothed (rarely nearly entire) to more or less pinnatifid, lanceolate in outline: bud oblong-ovoid, roundish at apex: petals orbicular or nearly so, entire or sometimes crenate or incised, cinnabar-red, deep purple to scarlet, white and variously marginate, sometimes dark-spotted, the fls. 2 in. or more across; stigmatic disk usually 10-radiate, but varying from 5-18. Eu. and Asia; run wild in N. Amer. Abundant in fields in Eu. Gn. 30, p. 297.—An immensely variable species,

from 25-30 botanical varieties and subvarieties being recognized; and the cultural variations are numberless. In cult. every shade known to the opium poppy has been reproduced in the corn poppy, but the fls. are always smaller. In the wild it varies greatly, the foliage once or twice pinnately parted, the bristles many or few, appressed or spreading, the fls. spotted or not. Up to 1886 the French poppies were considered the best strain. Since then the strain or race known as Shirley poppies has surpassed all others. This strain was developed by the Rev. W. Wilks, secretary of the Royal Horticultural Society. (See p. 2456.) Var. *ranunculiflorum*, Hort., is a strain with double fls. in various colors, self and variegated, with the petals entire, rounded and somewhat reflexed. Var. *japonicum*, Hort., is a strain intro. about 1893 from Japanese gardens, and said to have smaller and fuller fls. than ordinary and of more varied shades. They are called Japanese or Japanese pompons. *Rhæas* was the name used by the ancient Greeks and Romans for the corn poppy.

Var. *umbròsum*, Mott. (*P. umbròsum*, Hort.), has petals of a darker red than the typical *P. Rhæas*, and blackish spots. It was intro. by Vilmorin about 1891, and was considered a marked gain in productiveness. The habit is dwarf, compact, much branched. Soon after a double form was distributed. Mottet considers it a form of *P. Rhæas*, but some botanists consider it a form of *P. commutatum*, a species apparently not otherwise in garden cult. *P. umbròsum* was found growing wild in Attica.

Var. *Hoòkeri*, W. Miller (*P. Hoòkeri*, Baker). A puzzling plant found in gardens of India, and of unknown parentage. It is nearest to *P. Rhæas*, and "differs in its great size, for it forms a bushy herb 4 ft. high and upward, and in the great number of the stigmatic rays, which are 12-20, i. e., nearly double those of *P. Rhæas*; the fls., caps. and seeds also are much larger and the stigma broader in proportion." The fls. attain 3½ in. diam., and vary from pale rose to bright crimson, with a white or black spot at the base. B.M. 6729. Gn. 29, p. 139. G.C. II. 25:9.—

Said to revert occasionally to *P. Rhæas*.

The flower-garden forms of *P. Rhæas* give remarkable color effects. Probably no plant so quickly and cheaply satisfies one's love of color.

2751. Poppies in the year 1613. Five flowers from "Hortus Eystettensis" (redrawn and reduced, indicating the antiquity of some of the main types that are popular today). *P. somniferum*.

The season of bloom, which is mostly July in the N., is rather short, but it may be considerably extended by successive sowings and by not allowing the plants to seed. Begin to sow as early



as the land can be put in condition. Cover lightly, or the germination may be unsatisfactory. Thin to 6-12 in. apart. Self-sown seeds give earlier-blooming plants.

EE. Caps. more or less setulose.

6. *pavoninum*, Fisch. & Mey. (*P. pavonium*, Stschegl.). PEACOCK POPPY. Annual, more or less branched, 1 ft. or less high, hispid-pilose: lvs. pinnately parted, the divisions oblong-linear and incised-toothed, pilose: bud ovoid, nodding: fls. about 1 in. across; petals scarlet, dark-spotted: caps. minute, ovate; stigmatic rays 4-7. Sandy places of Turkestan and Afghanistan. G.C. II. 26:329.—Botanically it is very distinct by reason of 2 short horn-like appendages, one on each sepal near the tip on the back.

DD. St. elongated, sparsely leafy: biennial.

7. *caucasicum*, Bieb. Biennial, more or less setose, glaucous, 1-2 ft., the root fusiform, erect, paniculately branched: lvs. glaucous, sparsely setulose or the petiole densely so, lanceolate in outline, pinnately parted, the segms. pinnatifid and lobes ovate-oblong: buds ovate: calyx glabrous or sparsely setose; petals somewhat in pairs, roundish, pale scarlet and the claw usually yellowish: caps. oblong, glabrous; stigmatic rays 3-6. Caucasus. B.M. 1675 (brick-red, not spotted).

8. *floribundum*, Desf. (*P. caucasicum* var. *floribundum*, Elk.). Glaucous biennial, yellowish, hispid, the segms. of lvs. nearly entire or dentate: fls. vermilion, the stamens ochroleucus, handsome: caps. mostly oblong, glabrous. Caucasus region. B.R. 134.

9. *persicum*, Lindl. Biennial, setose-hispid, 1-2 ft., paniculately branched, st. pyramidal: lvs. glaucous, oblong-lanceolate in outline, pinnately parted, the segms. oblong-lanceolate and entire or dentate: buds oblong; calyx setose; petals overlapping



at the margin, deep red or brick-red, green-spotted at base: caps. large and broad, densely hispid; stigmatic rays 5-6. Persia. B.R. 1570 (petals brick-red, with or without a white spot at the base).—This has been, and may still be, confused in the trade with *P. caucasicum*.

cc. Herbage mostly glabrous (or very sparingly setulose), glaucous, the st.-lvs. clasping and nearly entire or incised-dentate.

10. *somniferum*, Linn. (*P. opififerum*, Forsk. *P. nigrum*, Crantz). OPIUM POPPY. Fig. 2751. Robust, glaucous and glabrous annual, 3-4 ft. high, with fls. 4-5 in. across, much larger than those of any annual

kind: lvs. oblong, unequally toothed at the base; st.-lvs. cordate at the base, sinuate-repand to dentate-serrate, very glaucous, clasping: fl.-bud ovoid-oblong, somewhat obtuse at apex, glabrous; petals orbiculate, entire, undulate or cut, from white through pink and red to purple, but not yellow or blue: caps. globose, glabrous, with a flat 8-12-lobed disk. Greece, Orient. Gn. 9, p. 197; 59, p. 127. Gt. 40, p. 609; 44, p. 593. R.H. 1893, p. 349. S.H. 2:272. G. 3:125 (as var. *nigrum*).—Sparingly run wild in N. Amer. Very variable in color of seeds, characters of caps., and form and color of petals. Var. *album*, DC. (*P. officinale*, Gmel.), has fls. and seeds white: caps. ovate-globose.

Among the double horticultural forms of *P. somniferum* are two main strains or types, the carnation-fl. and the peony-fl. (the latter *P. pœoniæflorum*, Hort.). The former has fringed petals; the latter not. Both include a wide range of color, and even a yellow form has been advertised, but this form is of doubtful authenticity. *P. Mursellii* is another strain of double fringed kinds, of which Mikado is a favorite. *P. fimbriatum* is another trade name for double fringed varieties. *P. cardinale* is the French name of another strain of double fringed fls. Chinese poppies are a double-fl. race intro. from Chinese gardens early in 1890, and comprising dwarfer strains than previously known. R.H. 1893, p. 349. An exceptionally interesting monstrosity has occurred in which there are no petals, and the stamens are supposed to be transformed into pistils which actually ripen seed. It was figured as long ago as 1851 in F.S. 6, p. 242, and again in R.H. 1893, p. 349. It seems to be no longer advertised, but it was considered to be constant.

Among the single varieties, Danebrog is one of the most striking and popular. The white spots at the base of the petals form a cross. This variety is also known as Danish Cross, Danish Flag and Victorian Cross. Of the pure white kinds, Flag of Truce and The Bride are favorites. Mephisto is scarlet, spotted black. About a dozen other varieties are advertised by name.

11. *setigerum*, DC. (*P. somniferum* var. *setigerum*, Elk.). Differs from *P. somniferum* in having deeply incised lvs. and 7-8 stigma-lobes, the petals violet, the plant more setulose in parts: stigma-lobes 7-8.—*P. setigerum* is apparently no longer advertised, but according to Nicholson numerous fine strains have originated from it. It is usually considered a hairy form of *P. somniferum*. It is a violet-fl. plant native to the Medit. region.

12. *glaucom*, Boiss. & Hausskn. (*P. somniferum* var. *glaucom*, O. Kuntze). TULIP POPPY. Annual (sometimes perennial?), glaucous and glabrous except a few small, appressed bristles along the peduncles, branched at the base: st.-lvs. broadly cordate at the base, pinnately lobed or parted; the lobes triangular, dentate; the teeth obtuse, callous, mucicous: bud ovoid, somewhat attenuate at top; petals large, scarlet, spotted at the base: caps. ovate, stalked; stigmatic rays about 12. Syria to Persia. Gt. 40, p. 608, repeated in G.C. III. 10:527, R.B. 20, p. 58, S.H. 2:467 and V. 15:37. R.H. 1892, p. 463; 1893, p. 350.—The plant sold under this name reminds one immediately of a tulip because of the color and texture of the fls., but especially because of its cuplike shape. The 2 inner petals are smaller, erect, and make a loose cup. The plants grow about 12-18 in. high and produce 50-60 large fls.

BB. Species perennial.

c. Sts. elongated, more or less leafy: caps. glabrous.

d. Branching dichotomous or corymbose.

e. Fls. racemose.

13. *pilòsum*, Sibth. & Smith (*P. olympicum*, Sibth. & Smith). Perennial: sts. tall and pilose, freely branched: lvs. covered with velvety, appressed hairs;

st.-lvs. clasping, broadly oblong, lobed and serrate; radical lvs. oblong, long-petioled: fls. 2 in. across, brick-red and showy, corymbose-racemose; petals roundish, repand: caps. glabrous, oblong-club-shaped; stigmatic rays 6-7. Rocky alpine heights of Mt. Olympus in Bithynia. B.M. 4749. Gt. 1:322. Gn. 41, p. 277; 42, p. 585.

EE. *Fls. solitary, or in 2's or 3's.*

14. *atlanticum*, Ball (*P. rupifragum* var. *atlanticum*, Ball). Perennial: hoary and everywhere covered with copious spreading hairs except the glabrous caps.: height 1-2 ft., from a thick woody root, the sts. scape-like: lvs. oblanceolate, coarsely and irregularly crenate-serrate or pinnatifid, the segms. entire or crenate-serrate; st.-lvs. smaller and sessile: bud broadly ovate, hispid, nodding: fls. 2-3 in. across; petals orange-red or scarlet; stigmatic rays 6-8: caps. club-shaped. Morocco, 6,000-7,000 ft. B.M. 7107.

15. *rupifragum*, Boiss. & Reut. Perennial, caespitose and many stemmed: lvs. mostly radical, oblong-lanceolate in outline, pinnatisect with rounded sinuses, the segms. irregularly oblong or lanceolate and dentate or nearly entire, glabrous or pilose on the nerves, but the scape-like sts. sparsely hispid; st.-lvs. smaller and narrower: bud broadly ovoid, glabrous, nodding: fls. 5-6 in. diam., pale red: caps. oblong-clavate, glabrous, the disk 8-rayed. Spain. Gt. 2, p. 66.

DD. *Branching slight, the sts. mostly peduncle-like although bearing lvs.*

16. *orientale*, Linn. ORIENTAL POPPY. Figs. 2752, 2753. Plants grow 3-4 ft. high, perennial, stiff-hairy, and bear fls. sometimes 6 in. or more across: lvs. hispid, pinnately parted; lobes oblong-lanceolate, the upper lobes coarsely serrate and the lower incise-dentate: petals sometimes 6, obovate, narrowed below, scarlet with blackish base: caps. obovate, with a flat disk; stigmatic rays 13-15. Medit. region to Persia. B.M. 57. Gn. 24, p. 459; 42:584. Gn. M. 5:16. V. 12:33.—A popular perennial, now in many forms. The petals are originally apparently scarlet with a black spot. It was not until late in the 80's of the past century that this species made a decided break in color. A considerable class of hybrids with *P. bracteatum* has arisen which extends the color range through several shades of red to orange, salmon, and pale pink. Some are unspotted, some are adapted to cutting, and doubling has made some progress. Among the Latin names of varieties belonging to this class are *grandiflorum*, *hybridum*, *immaculatum*, *natum*, *splendens*, *Parkmanii*, *plenum*, *semi-plenum*, and *Sintenii*. Several have received common or personal names. Possibly some of these names belong rather with *P. bracteatum*.—Oriental poppies are better divided after blooming, in late July, or Aug., when they are dormant; but the roots should not be disturbed if the best bloom is expected the following season. They always grow in the autumn, and these divided plants would start away and make good growth. If divided in spring, they would not recover in time to bloom. Any extra-good variety may be increased largely by cutting the roots into short pieces. This also is best accomplished in summer. No plant is more brilliant in late spring or early summer than the oriental poppy, with its large fls., silken petals and flaming colors, although its season of bloom is short.

17. *bracteatum*, Lindl. (*P. orientale* var. *bracteatum*, Ledeb.). Differs from the preceding in having large leafy bracts below the fl.: perennial, erect, setose: radical lvs. pinnate-parted, the upper ones incised, segms. lanceolate or oblong: petals sometimes 6, obovate attenuate to base, blood-red and not spotted or the claw dark violet: stigmatic disk 16-18-rayed. Medit. region to Persia. B.R. 658. G.C. 1860:647.—A variety with petals more or less united into one was mentioned in 1862-5 in F.S. 15, p. 186.

CC. *Sts. very short, so that the plant is practically acaulescent, the fls. solitary on scapes.*

D. *Scapes very short, usually not exceeding 4 in. but sometimes twice that height.*

18. *pyrenaicum*, Kern. Low and caespitose perennial, nearly stemless: lvs. green, all radical and petiolate, appressed pilose or setose (sometimes nearly glabrous), pinnately parted, the segms. ovate, ovate-lanceolate, entire, or seldom pinnatifid: scapes 1 or several, usually 2-4 in. high in the wild but sometimes twice that height, the bud ovoid, pilose, nodding: fl. yellow to orange; petals round-obovate, more or less erose, nearly 1 in. or less long: caps. oblong or obovoid, strongly ribbed. Pyrenees, Alps, Apennines.

19. *alpinum*, Linn. ALPINE POPPY. Low and caespitose perennial, nearly stemless: lvs. glaucous, all radical and petiolate, glabrous or nearly so, 2-3-pinnately parted, the ultimate segms. linear or linear-lanceolate:



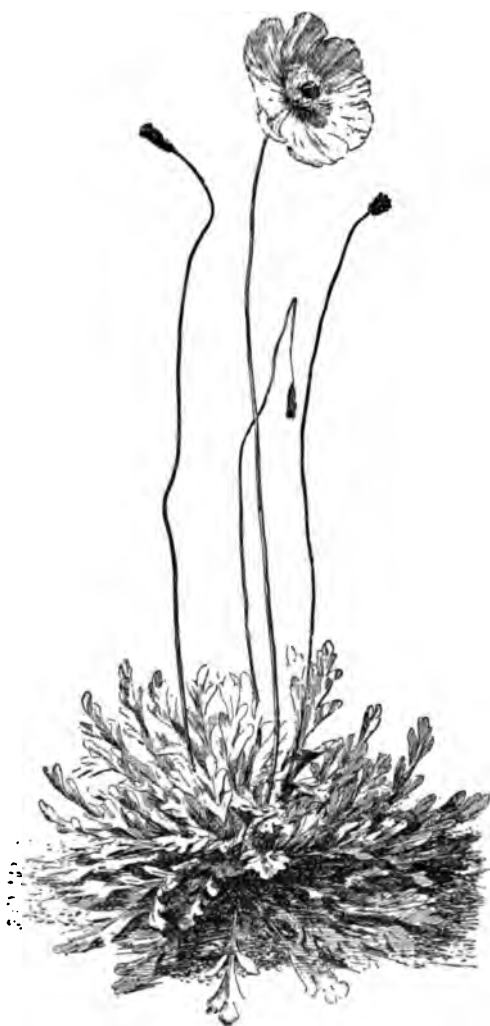
2753. *Papaver orientale*, the most popular perennial poppy.

scapes single or several, the bud ovoid or round-obovoid, usually pilose, nodding; fls. white, fragrant; petals round-obovate, erose, nearly 1 in. long or less: caps. oblong to obovate, strongly ribbed. Alps, Apennines.—The following garden varieties have been offered as of this species, but some of them are probably *P. pyrenaicum*: *albiflorum*, *album*, *aurantiacum*, *flaviflorum*, *flavum*, *roseum* and *rubrum*. *P. luteum*, Hort., belongs here, but *P. luteum* of the botanists is the Welsh poppy, *Meconopsis cambrica*.

DD. *Scapes longer, particularly in cult.*

20. *nudicatile*, Linn. ICELAND POPPY. Fig. 2754. Mostly a yellow-fl. arctic perennial, more robust than the two preceding, caespitose, nearly stemless: lvs. all radical and petiolate, somewhat glaucous, glabrous or hairy, pinnatifid, the segms. oblong and entire or lobed: scapes single or several, usually 1 ft. high, the bud ovoid or nearly globose, pilose, usually nodding; fls. 1-2 in. diam., sweet-scented; petals obovate and sinuate, white with yellow base or yellow with greenish base, the 2 inner ones smaller: caps. oblong or obovate-glo-

boose, hispid or rarely glabrous. Arctic regions. E. and W. hemispheres.—The species runs into very many botanical forms. In America a form or similar species is found as far south as S. Colo. Gn. 26:380; 24, p. 342; 28, p. 58; 42, p. 584; 79, p. 42. G. 6:321; 7:66. V. 13:297. B.M. 1633; 3035, and R.H. 1890:60 (*P. croceum*). F. S. 10:1017 (as var. *croceum*). The following varieties are in the trade: *album*, *aurantiacum*, *coccineum*, *crœcum*, *striatum*, and *sulphureum*. Double forms in the various colors are advertised. Older names which are likely to appear are vars. *luteum*, *puniceum*, and *rubro-aurantiacum*. B.M. 2344. The name "nudicaule" refers to the lack of lvs. on the scape, which distinguishes this and the alpine poppy from the common corn poppy of Eu. *P. greenlandicum*, Hort., is possibly a catalogue name for *P. nudicaule*. The Iceland poppy is a favorite for spring bloom. It is a hardy perennial, but blooms the first year from seed. It has neat evergreen foliage on the ground.



2754. Iceland poppy, *Papaver nudicaule*. ($\times \frac{1}{4}$)

The colors have been much varied in the cult. sorts, so that the gardener has choices in pure white, bright yellows, orange, and orange-scarlet. If the seed-pods are continuously removed, the plant will bloom throughout most of the summer. The fls. are very useful for cutting.

P. Helderichii, Hort.—*P. Schinzianum*, below.—*P. heterophyllum*, Greene—*Meconopsis heterophylla*.—*P. Hopkinsii*, Hort. Apparently perennial, and described as a particularly good poppy of medium height with deep scarlet fls. on slender graceful sts. Offered abroad.—*P. Monstii*, Hort. Spontaneous hybrid between *P. glaucum* and *P. Rhœas*.—*P. pilosobracteatum* is a garden hybrid, as indicated in the name.—*P. Schinzianum*, Fedde. Probably a garden hybrid between *P. rupifragum* and a species allied to *P. lateritium*, and which has been cult. as *P. Helderichii*: fls. brick-red; petals suborbicular-obovate, to $1\frac{1}{4}$ in. long; caps. obovoid-clavate.

WILHELM MILLER.
L. H. B.†

PAPAYA (Fig. 2755). The papaya (*Carica Papaya*) is a well-known edible fruit which has spread from its original home in America throughout the tropical world, and is a favorite fruit in many regions. In Hawaii it is said to rank next to the banana in popularity; in nearly all parts of tropical America it is one of the commonest fruits, while early in the seventeenth century it became known in the Orient and is now grown in India, Ceylon, the Malay Archipelago, and many other regions, as well as in tropical Africa and Australia. The name papaya is considered a corruption of the Carib ababai, which in one form or another has been carried around the world; papaia, papeya and papia are some of the various adaptations which are in use. The English name papaw (or pawpaw) is probably derived from the same source, and is widely used; in the United States it has the disadvantage of confusing this fruit with *Asimina triloba*, which is well known in the central and southeastern states under the same name. The Portuguese name, current in Brazil, is mamão (the tree mamoeiro), a word probably referring to the mammiform apex of the fruit; in the French colonies it is called papaye (the plant papayer); in German colonies papaja and papajabaum, or melonenbaum. Several other names are used in tropical America, notably fruta de bomba in Cuba, lechosa in Porto Rico, melon zapote in parts of Mexico, and tree melon in English-speaking countries.

The papaya—a giant herbaceous plant rather than a tree—grows to a height of 25 or 30 feet, and is often likened to a palm in general appearance, though there is, of course, no botanical relationship. The trunk is commonly unbranched, bearing toward its apex large soft deeply-lobed leaves sometimes 2 feet across, upon stiff hollow petioles 2 feet or more in length. The wood is fleshy, the bark smooth, grayish brown, marked by prominent leaf-scars.

The plant is normally dioecious, and produces its flowers in the uppermost leaf-axils, the staminate ones sessile on pendent racemes 3 feet or more in length, the pistillate ones subsessile and usually solitary or in few-flowered corymbs. The staminate flowers are funnel-shaped, about an inch long, whitish, the corolla five-lobed, with ten stamens in the throat; the pistillate flowers are considerably larger, with five fleshy petals connate toward the base, a large cylindrical or globose superior ovary, and five sessile fan-shaped stigmas.

Beside the typical dioecious form, in which male and female flowers are confined to separate plants, it is not unusual to find various other distributions of the sexes; these have been studied in Hawaii by Higgins and Holt, who describe (Hawaii Agricultural Experiment Station, Bulletin No. 32) a number of different forms, such as the occurrence of staminate flowers with more or less rudimentary stigmas and ovaries which sometimes give rise to small fruits; a hermaphrodite form, which regularly produces perfect flowers and good fruits; and various other combinations of staminate, pistillate and hermaphrodite flowers on the same and different plants. It will thus be seen that the distribution of the sexes in the papaya is very irregular; it has been reported by some authorities, indeed, that severe pruning or injury to the tree sometimes results in a change of sex, but this has been observed only on staminate trees of the dioecious type.

Aside from these variations in the distribution of the

sexes, there are marked differences in the size, shape and quality of the fruits produced by different seedlings of the typical dioecious form, and the papayas of certain regions in the tropics are uniformly superior to those of other regions. In Bahia, Brazil, there are two distinct types, one with small nearly spherical fruits not over 6 inches in diameter, and a very superior type called "mamão da Índia" which produces fruits 18 inches long, cylindrical in form, and of excellent flavor. With the recent discovery of a method of grafting the papaya, which is fully described under Carica (page 663; cf. also Circ. No. 119, Bur. Pl. Ind., U. S. Dept. Agric. 1913), the propagation of superior seedlings has been made possible. In addition, much can be done to improve the quality of the fruit through the selection of seed, but the number of males which arise is usually much greater than is necessary to furnish pollen for the female trees. Through vegetative propagation, it is possible to eliminate all unnecessary males and propagate only a sufficient number to furnish the required pollen—not more than one in ten.

The fruit is commonly spherical or cylindrical in form, round or obscurely five-angled in transverse section, from 3 up to 20 or more inches in length, sometimes weighing twenty pounds or over. In general character it strongly resembles a melon; the skin is thin, smooth on the exterior, orange-yellow to deep orange in color, while the flesh, which is concolorous with the skin, is from 1 to 2 inches thick, and incloses a large sometimes five-angled cavity, to the walls of which are attached the numerous round wrinkled and blackish seeds, the size of small peas, inclosed by a thin gelatinous aril.

The flavor is rather sweet, with a slight musky twang which is sometimes objectionable to the novice, and which varies greatly in amount; the best types are of a bland agreeable taste which is almost sure to be relished, and which makes the papaya one of the most popular breakfast fruits in many tropical countries. In Brazil the flavor is thought to be improved if the fruit is lightly scored when taken from the tree, and then allowed to stand for a day so that the milky juice may run out. While most commonly used, perhaps, as a breakfast fruit, like the muskmelon in northern countries, the papaya can be prepared in numerous ways. In Brazil it is served as a dessert, sliced, with the addition of a little sugar and whipped cream. As a salad, in combination with lettuce, it is excellent. As a crystallized fruit it is good, but it has not very much character. When green it is sometimes boiled and served as a vegetable, much as summer squash is in the North. It can also be made into pickles, preserves, jellies, pies, and sherbets. When used as a breakfast fruit it is cut in halves longitudinally, and after the seeds are removed, served with the addition of lemon juice, salt and pepper, or sugar, according to taste.

In the tropics, papayas are in season during a large part of the year, and the yield is enormous, single trees bearing in the course of their lifetime a hundred or more of their immense fruits. In Florida the season extends from December to June, with occasional fruits ripening at other times. While considered a rather difficult fruit to ship, especially when fully ripe, papayas have been sent from Hawaii to San Francisco and marketed in the cities of the Pacific coast. According to Higgins and Holt, the best method of shipment is to wrap the fruits separately in paper, then encase them in cylinders of corrugated strawboard, and pack them in single-tier crates. They should be picked when they show the first signs of ripeness. Refrigeration during the voyage is important.

The fruit of the papaya, as well as all other parts of the plant, contains a milky juice in which an active principle known as papain is present. This enzyme, which was first separated by Peckholt, greatly resembles animal pepsin in its digestive action, and in recent

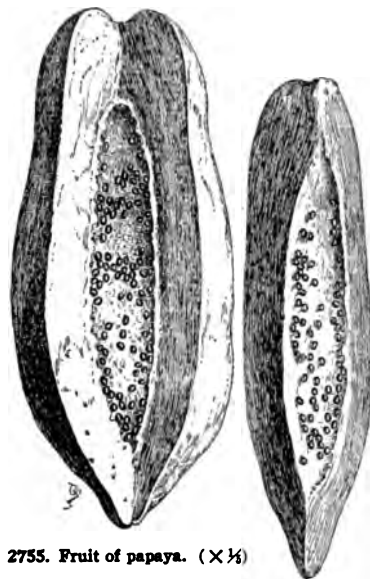
years has become an article of commerce. Aside from its value as a remedy in dyspepsia and kindred ailments, it has very recently been utilized for the clarification of beer. Its digestive action has long been recognized in the tropics, as evidenced by the common practice of the natives, who rub the juice over meat to make it tender, or wrap a fowl in papaya leaves and let it stand overnight before cooking it.

The papaya succeeds best in regions with a warm climate and rich loamy but well-drained soil. In south Florida it appears to prefer the richer hammock soils to those of pine-lands, but may be very successfully grown on the latter with proper fertilizing. On the Florida Keys, the plant has become thoroughly naturalized, and springs up wherever a clearing is made, the seeds being scattered by birds and other agencies. It withstands but little frost, although it is occasionally possible to fruit it toward the northern part of the state when a mild winter allows it to reach its second summer without injury. In California, the papaya has never been very successful, probably because the nights are too cool to mature the fruit perfectly. It has been noticed in the tropics that fruit ripened in cool weather is poor and somewhat squash-like in flavor. The best locations in southern California are the protected foothill regions, where the ground is sloping and the soil well drained, and where the heat during the summer months is more intense than on the seacoast. An old tree at Hollywood, Los Angeles, bore fruit for several years, but finally succumbed to the cold rains of winter, which often cause the plants to rot off at the base, especially if the drainage is the least bit defective.

In Hawaii the papaya is said to succeed on almost any soil, provided it is well drained. As soon as the plants are well started they like plenty of moisture, and are rank feeders. On the shallow soils of south Florida, organic nitrogen should be abundantly supplied.

The papaya is easily grown from seed, which in Florida should be planted as early as possible,—preferably in January,—in order to have the plants in fruit by the following winter. If seeds are washed and dried after removal from the fruit, and stored in glass bottles, they will retain their viability for several years. A light sandy loam is a good medium for germination, and the seeds should be sown rather thickly about $\frac{1}{2}$ inch deep. They may be potted off when they have made their third leaves, and from pots later set out in the ground. As the stems of young plants are very succulent, care should be taken to avoid damping-off.

For a permanent orchard, the plants should be set not less than 10 feet apart. The papaya is short-lived, and will not usually remain in profitable bearing more than two to four years. That it is of extremely simple culture is proved by the ease with which it becomes naturalized in tropical regions, and the thriftiness of the wild plants.



2755. Fruit of papaya. ($\times \frac{1}{4}$)

Two pests have become sufficiently troublesome in south Florida to require attention, one of which, the papaya fruit-fly (*Toxotrypana curvicauda*), threatened at one time to become serious (Cf. Journ. Agr. Research, ii. 447-453, Knab & Yothers). This insect occurs in several parts of tropical America; the female inserts her eggs into the immature papaya by means of a long ovipositor, and the larvæ first feed in the central seed-mass, but later work into the flesh of the fruit, frequently rendering it unfit for human consumption. The only means of control which have been suggested are the destruction of wild plants and infested fruits, and the production of varieties of the papaya with very thick flesh, so that the female will be unable to reach the seed cavity with her ovipositor;—the young larvæ are unable to live in the flesh. A fungous disease, known as papaya leaf-spot (*Pucciniaopsis caricæ*) frequently attacks the foliage during the winter season, forming small black masses on the under surfaces of the leaves. It is not very destructive, and easily controlled by spraying with bordeaux mixture. F. W. POPENOE.

PAPÈDA (Malayan name). *Rutaceæ*, tribe *Citreeæ*. Under this name Hasskarl in 1842 created a new genus to include a form closely related to if not identical with *Citrus Hystrix*, DC. A number of species of *Citrus* closely related to *C. Hystrix* have been reported from the Indo-Malayan and western Polynesian regions. As these species are for the most part only imperfectly described, it is doubtful whether they are valid species or forms of one polymorphic species. This group of forms may constitute a subgenus under *Citrus*, distinguished by having very large broad-winged petioles sometimes equaling or even exceeding in area the lamina, small fls. with free stamens, rough frs. with sour and acrid pulp composed of very short pulp-vesicles, containing oil in the center. *Citrus (Papèda) Hystrix*, DC., probably includes *Papèda Rumphii*, Hassk. The forms of this subgenus are sometimes used in the Philippines as stocks on which to graft the commonly cult. species of *Citrus*. The frs. are not edible but are used by the natives of the Malayan and Polynesian islands in lieu of soap for washing the hair.

WALTER T. SWINGLE.

PAPER PLANT: *Cyperus Papyrus* and *Papyrus antiquorum*.

PAPHINIA (Paphos, city of Cyprus, sacred to Venus). *Orchidaceæ*. A rare and pretty genus of orchids, having the habit of small lycopastes.

Flowers curiously shaped, borne on pendent scapes which are mostly 2-fld.; sepals and petals similar, spreading; mentum obsolete, labellum uppermost in the fl. They may be easily grown with lycopastes, and should be planted in fibrous peat and moss. During the growing period they require a liberal supply of water.

cristata, Lindl. (*Lycaste cristata*, Nichols.). Pseudobulbs ovate, 1-3-lvd.; lvs. lanceolate, 4-6 in. long; scapes pendent, 1-2-fld.; sepals and petals lanceolate, acuminate, spreading, the latter a little smaller; all streaked above and transversely banded below with deep crimson or chocolate-brown markings on a whitish ground; labellum much smaller, chocolate-purple; the 2 lateral lobes oblong, pointed, half spreading, separated from the middle lobe by a deep constriction; middle lobe triangular-rhomboid, with an erect crest and clavate glands on the disk, and bordered in front by a fringe of clavate hairs. June-Aug. Trinidad. B.M. 4836. B.R. 1811 (as *Maxillaria cristata*). Gn. 78, p. 33.

rugosa, Reichb. f. Pseudobulbs small, rounded; lvs. small, linear, acuminate; fls. waxy, creamy white, covered with red spots, which run together in blotches. Colombia.

grandiflora, Rodrig. (*P. grandis*, Reichb. f.). Fls. chocolate-brown, striated on the lower half of the sepals and petals with greenish yellow and cream-color, mar-

gins cream; labellum dark purple at the base, with an oblong, cream-colored middle lobe, and a pair of small lobes on each side. Brazil. G.C. III. 14:561.—A curious orchid.

P. Lawrenceana—*Lycaste Lawrenceana*(?).

HEINRICH HASSELBRING.

PAPHIOPEDILUM (from Paphos, *Paphnia* see, and Latin for sandal). *Orchidaceæ*. Terrestrial or epiphytic orchids grown in a warm greenhouse; comprises the glasshouse cypripediums.

Rhizome somewhat creeping: lvs. coriaceous, keeled below, sulcate above, conduplicate in veneration, green or tessellated; fls. showy; sepals 3, the dorsal erect, showy, the lateral united; petals spreading or pendulous; lip saccate, the margin of the orifice not inflexed; column short; ovary 1-celled, with parietal placentæ.—About 50 species in Trop. Asia, Malay Archipelago, Philippines. Differ from *Cypripedium* chiefly in having the lvs. conduplicate in the bud instead of convolute and in having a deciduous perigonium instead of withering and persistent. Cf. Pfützer, *Pflanzenreich*, hft. 12.

Cultivation of paphiopedilums. (Alfred J. Loveless.)

Paphiopedilums generally are of easy culture, and may be grown in one house by devoting the cool end to *P. insigne* and its hybrids, and the selenipedium group. The plants should never be allowed to become dry, as they are making active growth most of the time. Light spraying should be frequent in bright weather, and an application of very weak liquid manure occasionally will be found of great assistance in keeping the plants healthy. Ventilation regulated according to external conditions is essential at all times to maintain atmospheric action.

During the winter months the thermometer should register from 55° to 60° F. by night, and about 65° F. by day, with sun heat a few degrees higher doing no harm. On the approach of spring the temperature should be slightly advanced to prepare the plants for summer heat, and accordingly decreased on the approach of fall. A light shading will be necessary at all times, to prevent excessive heat and sunburn, with heavier shading toward midsummer by the addition of bamboo shades, these to be removed in autumn, and dispensed with during the winter.

The greater part of the species grow best in pots, in a compost composed of two parts peat-fiber, one part turfy loam, one part chopped living sphagnum, one-third of the pot room being devoted to clean drainage. The compost should be pressed in rather firmly around the roots, finishing off about ½ inch below the rim of the pot. A sharp lookout should be kept for thrip, and clean pots, with frequent sponging of the foliage, is essential to the good health of the plants. *P. insigne* and kindred species should have one part chopped sod added to the above mixture (see note on culture in Veitch's "Orchid Manual" 2:34). *P. villosum* and *P. Exul* sometimes suffer under pot culture from fungi, which attack the base of the plant in sultry summer weather. Basket culture will obviate this, as it allows a better circulation of air through the compost. *P. Lowei*, *P. Parishii*, *P. philippinense* and allied species, together with *Selenipedium caudatum*, are truly epiphytic and preferably should be grown in baskets. By this method the roots are better preserved and less liable to decay during the winter season.

The concolor section requires a warm moist location with free access to the air. The species should be grown in rather small pots, with at least half the space devoted to drainage of broken charcoal or other free material. The potting compost should consist of equal parts chopped sod, peat-fiber and living sphagnum. Limestone is often recommended as essential in the culture of this section, but the conditions being exact it gives no beneficial results (Orchid Review 4:45; Veitch's Manual 2:19, 20).



LXXXIV. A plantation of papaya in the Hawaiian Islands.

11

The deciduous tropical species require similar treatment to the evergreen kinds. They have a long dormant period during which they should be rested in a temperature of 50° F., with sufficient water to keep the compost moist until growth starts, when they must be returned to their proper department and enjoy a liberal supply of water until after the flowering season, when they must be ripened off and the water supply gradually withheld.

The hardy species (true cypripediums) do better planted out in the open ground or in rockeries, where they should be so situated as to have good drainage and shade. The soil must be free and porous and consist of three parts chopped turf and equal parts of peat and sphagnum. They require a liberal supply of water and frequent syringing over the foliage while growing, but the supply should be gradually reduced after the flowering period until only enough water is given to keep the soil moist. During the winter the plants should be protected with leaves or pine boughs. *Cypripedium reginae* and *C. pubescens* grow well under pot culture. A 7- to 10-inch pot will hold eight or a dozen crowns, which should be planted 2 inches below the surface. Two inches of drainage are sufficient. The pots should be filled with soil (firmly pressed in) to $\frac{1}{2}$ inch below the rim. After a thorough watering they should be stored in a coldframe and protected with leaves and boughs. About the middle of February they may be removed to a coolhouse, where they should remain for a week, and then be placed in the cool end of the cypripedium house, where they should be watered sparingly until growth-action starts. These plants make strong growths under this treatment, and the flowers are a decided improvement over those produced outside. See *Cypripedium* and *Phragmopedilum*.

All paphiopedilums are propagated by division, but many beautiful hybrids have been added to the list, since the raising from seed has been better understood.

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GENERAL KEY TO SECTIONS.

- A. Petals broadly elliptic or almost orbicular. SECTION I. Species 1-4.
AA. Petals elongated.
B. Pouch of lip not eared: lvs. green, strap-shaped. SECTION II. Species 5-10.
BB. Pouch of lip eared: lvs. various. SECTION III. Species 11-42.
SECTION I.
A. Fls. bell-shaped.
B. Lip shorter than the petals. 1. bellatulum
BB. Lip as long as the petals. 2. Godefroyae
AA. Fls. spreading.
B. Scape shorter than lvs. 3. concolor
BB. Scape longer than lvs. 4. niveum

1. *bellatulum*, Pfitz. (*Cypripedium bellatulum*, Reichb. f.). Lvs. oblong-elliptic, up to 10 in. long and $3\frac{1}{2}$ in. broad, the upper surface deep green mottled with paler green, the lower surface dull purple: scape shorter than lvs., 1-fl., purple, pubescent; fls. pale yellow or white, spotted with brown-purple; dorsal sepal orbicular, concave, ciliate; petals broadly oval; lip with fewer and smaller spots than the sepals and petals. Summer. Shan States, China. G.C. III. 21:321. J.H. III. 30:513; 43:49. A.F. 6:557; 13:77, 622; 14:675. Gng. 7:129. G. 34:399. G.M. 55:593. O. 1912, p. 19. L. 4:149. C.O. 9. Var. *album*, Rolfe. Fls. white, the lvs. not colored beneath. C.O. 9a. Var. *Chotekae*, Hort. The larger fls. with larger spots. L. 665. Var. *egregium*, Hort. Sepal short, 3-lobed, the spots light purple. Var. *luteo-purpureum*, Pfitz. Fls. pale yellow, purple-spotted. Other minor varieties are: *biflorum*, *giganteum*, *grande*, *grandiflorum*, *lineatum*, *Löwii*, *majus*, *roseum*, *superbum*.

2. *Godefroyae*, Pfitz. (*Cypripedium Godefroyae*, Rolfe. *C. concolor Godefroyae*, Hemsl.). Lvs. up to 6 in. long and $1\frac{1}{4}$ in. wide, deep green, marbled and spotted with paler green on the upper surface, the lower surface spotted with brown-purple: scape shorter than lvs., pubescent, green, purple-spotted, 1- or 2-fl.; fls. white or pale yellow, lightly pubescent, spotted magenta; dorsal sepal nearly orbicular; petals oblong-elliptic, deflexed; lip with the spots very small. Summer. Cochinchina. B.M. 6876. G.W. 14, p. 367. G.Z. 31:169. Gn. 25, p. 396. G.C. II. 23:49. Var. *Laingii*, Pfitz. Fls. smaller, white with purple dots. Var. *leucochilum*, Pfitz. Fls. white, the sepals and petals purple-spotted. Var. *Maris*, Pfitz. Fls. large, the white petals with black-purple spots. Other minor varieties are: *amphidactylum*, *hemi-zanthinum*, *Smithii*, *striatum*, *superbum*, *viridifolium*.

3. *concolor*, Pfitz. (*Cypripedium concolor*, Batem.). Lvs. up to 6 in. long and $1\frac{1}{2}$ in. wide, oblong-oval, deep

green, mottled above with grayish green, below spotted with deep crimson: scape shorter than lvs., 1- or 2-fld.; fls. pale yellow, dotted with purple; sepals and petals ciliolate; dorsal sepal nearly orbicular; petals broadly oblong-elliptic, deflexed; lip small, nearly cylindric, somewhat laterally compressed. Autumn. Moulmein. B.M. 5513. G.C. 1865:626; II. 19:19; III. 9:501. I.H. 12:444. F.S. 22:2321. G.Z. 30:97. Var. *chlorophyllum*, Pfitz. Lvs. concolored, not mottled: fls. with numerous dots. Var. *longipetalum*, Pfitz. Petals obovate, narrower than and almost twice as long as sepals. Var. *Requieri*, Pfitz. Larger, with sepals violet-spotted externally. Var. *sulphurinum*, Pfitz. Fls. sulfur-colored: lvs. green. Var. *tonkinense*, Pfitz. (*C. tonkinense*, Godefr.). Sepals and petals larger. L. 77.

4. *niveum*, Pfitz. (*Cypripedium niveum*, Reichb. f.). Lvs. up to 6 in. long and $1\frac{1}{2}$ in. broad, dull dark green above, spotted gray-green, lurid purple beneath: scape equaling or longer than lvs., 1- or 2-fld.; fls. white; sepals and petals ciliolate; dorsal sepal orbicular, concave, reddish purple on the back; purple-dotted in front toward the base; petals broadly oblong or nearly orbicular, a little deflexed; lip shorter than sepals and petals. Spring. Loncavi and Tambilan Isls. B.M. 5922. G.Z. 19:17. J.H. III. 45:559. Var. *album*, Pfitz. Fls. pure white. Var. *punctatum*, Pfitz. Base of petals densely violet-dotted. Var. *reticulatum*, Pfitz. Petals purple-reticulated at the apex, the nerves purple-spotted. Other minor varieties are: *punctatissimum*, *Requieri*, *roseum*.

SECTION II.

- A. Sepals with simple nerves, no cross-nerves.
 B. Length of petals flat, ciliate. 5. *Rothschildianum*
 BB. Length of petals twisted, the margins with hair-bearing warts.
 C. Length of petals 6 in. or less.
 D. *Staminodium* pointed in front.
 E. Point a long beak. 6. *glanduliferum*
 EE. Point short. 7. *præstans*
 DD. *Staminodium* notched in front. 8. *philippinense*
 CC. Length of petals over 1 ft. 9. *Sanderianum*
 AA. Sepals with the nerves united by slender cross-nerves, hence reticulated. 10. *Stonei*

5. *Rothschildianum*, Pfitz. (*Cypripedium Rothschildianum*, Reichb. f. *C. neo-guineense*, Lind.). Fig. 2756. Lvs. up to 2 ft. long and 3 in. wide, glossy green: scape erect, a little exceeding the lvs., violet, minutely pubescent, the bract yellowish green, ciliate, lined with black-purple; fls. about 5 in. in long diam.; dorsal sepal ovate, acute, ciliolate, about 15-nerved, yellow, lined with black-purple; petals about 5 in. long, twice larger than sepals, linear, 7-nerved, undulate, pale green, purple-spotted; lip about as long as sepals, lateral somewhat compressed, dull purple, the apex yellow. Winter. Borneo and Sumatra. R. 2:61. B.M. 7102. V.O. 4:45. G.F. 6:145. A.G. 21:91. G.C. III. 27:137. Gt. 51, pp. 486, 487. J.H. III. 60:3. R.B. 24:221. Var. *Elliotianum*, Pfitz. (*Cypripedium Elliotianum*, O'Brien). Fls. ivory-white, red-lined; petals shorter; *staminodium* acutely 2-toothed at apex. Philippines. L. 4:186. J.H. III. 32:55. A.F. 6:557; 7:855. Var. *platytanum*, Hort. Sepals and petals longer and broader than in the type. L. 623.

6. *glanduliferum*, Pfitz. (*Cypripedium glanduliferum*, Blume. *C. præstans*, Veitch, not Reichb. f.). Lvs. strap-shaped, up to 8 in. long and nearly 1 in. wide: scape dull purple, 1-fld., scarcely exceeding lvs., or several-fld. and exceeding the lvs.; fls. green and rose; dorsal sepal narrowly ovate, acute, about 13-nerved, nearly $1\frac{1}{2}$ in. long; petals about $2\frac{1}{4}$ in. long, deflexed, lanceolate and long-attenuate from a rhomboid base, twisted, the undulate margins with hair-bearing warts; lip about equaling the petals, the broad claw about half the length of lip, the basal lobes very narrow, involute,

the sac very short and confined to apex of lip. Summer. New Guinea.

7. *præstans*, Pfitz. (*Cypripedium præstans*, Reichb. f. *C. glanduliferum*, Veitch, not Blume). Lvs. strap-shaped, up to 1 ft. long and $2\frac{1}{4}$ in. wide: scape about equaling lvs., black-purple, pubescent, several-fld.; dorsal sepal oblong, acute, about 15-nerved, whitish, purple-lined, yellowish on back, about 2 in. long; petals yellow, about 5 in. long, twisted, cuneate-elliptic and long-attenuate from a narrow base, the undulate margins with hair-bearing warts; lip a little longer than the sepals, shining, yellow suffused red, the sac laterally compressed conic. Aug. New Guinea. L. 3:102. I.H. 34:26. Var. *Kimballianum*, Hort. (*Cypripedium præstans* var. *Kimballianum*, Hort.). Lines on the sepals broader; petals broader at base, densely red-lined, the warts larger; lip white, rose-suffused. New Guinea. L. 249.

8. *philippinense*, Pfitz. (*Cypripedium philippinense*, Reichb. f. *C. lævigatum*, Batem.). Lvs. oblong-ligu-



2756. *Paphiopedilum Rothschildianum*.
($\times \frac{1}{4}$)

late, up to 1 ft. long, glossy: scape up to $1\frac{1}{2}$ ft. tall, 3-5-fld.; fls. 3 in. largest diam.; dorsal sepal broadly ovate, acute, whitish, striped purple-brown; petals linear, twisted, 5-6 in. long, ciliate, with small hair-bearing basal warts, yellowish at base, passing into dull purple, the apex pale green; lip buff-yellow, lined faintly with brown. April and May. Philippines. B.M. 5508. G.C. 1865:914. F.M. 298. B.H. 1867:6. F.S. 17:1760, 1761. G.F. 3:309. Var. *platytanum*, Desb. Petals a little longer and twice broader than in type. Var. *Cannertianum*, Pfitz. (*Cypripedium Cannertianum*, Lind. *C. Roebelenii* var. *Cannertianum*, Pucci). Lateral sepals not united as in type.

9. *Sanderianum*, Pfitz. (*Cypripedium Sanderianum*, Reichb. f.). Lvs. up to 1 ft. long; scape barely as long as lvs., purple, pubescent, several-fld.; fls. about 4 in. largest diam.; dorsal sepal broadly lanceolate, concave, acute, ciliolate, pale yellowish green with broad brown lines, pubescent on back; petals linear, twisted, $1\frac{1}{2}$ ft. long or more, ciliate at the broader base, pale yellow margined with brown-purple at base, above this spotted with brown-purple, the remainder, the greater part, dull purple barred or spotted here and there with pale

yellow; lip brown-purple above, pale yellow beneath. Feb.-May. Malay Archipelago. G.C. III. 19:329. Gt. 43, p. 520. R. 1:3.

10. *Stönei*, Pfitz. (*Cypripedium Stönei*, Hook.). Lvs. up to 1½ ft. long; scape up to 2 ft. tall, greenish purple, pubescent, 3-5-fld.; fls. about 4 in. greatest diam.; dorsal sepal cordate, acuminate, white, with usually 2 or 3 dark crimson streaks; petals 5-6 in. long, linear, twisted, sparsely ciliate at base, the lower two-thirds pale tawny yellow, crimson-spotted, the remainder crimson; lip dull rose, veined and reticulated with crimson, the narrow infolded lobes whitish; staminodium fringed except in front. Autumn. Borneo. B.M. 5349. I.H. 10:355. F.S. 17:1792, 1793. L. 6:281. Var. *acrosépalum*, Reichb. f. Dorsal sepal narrower than in type, the lateral sepals free. Var. *Cannærtianum*, Hort. Dorsal sepal white; petals longer than in the type, creamy white with a central line of chocolate spots. Var. *platytænium*, Reichb. f. Fls. larger, the petals much broader, white, spotted with yellow and purple, the apex carmine. G.C. 1867:1118. F.M. 1880:414.

SECTION III.

- A. Scape several-fld.
 B. Fls. all appearing at same time: lvs. nearly erect.
 C. Petals with hairy warts, narrow, pendent, much twisted..... 11. *Parishii*
 CC. Petals without warts, dilated at apex, divaricate.
 D. Staminodium cordate, with a tooth in the sinus; apex of petals 4 times broader than lower half..... 12. *Loweii*
 DD. Staminodium oval, 2-lobed; petals but little broader at apex..... 13. *Haynaldianum*
 BB. Fls. appearing in succession: lvs. recurved.
 C. Lvs. green, more or less netted.
 D. Pouch long and narrow..... 14. *Victoria-Mariae*
 DD. Pouch short and broad..... 15. *Chamberlainianum*
 CC. Lvs. glaucous, not netted..... 16. *glaucophyllum*
 AA. Scape 1-, very rarely 2-, fld.
 B. Lvs. not netted or reticulated: sepals always netted.
 C. Staminodium not lunate.
 D. The staminodium with 3 protuberances..... 17. *hirsutissimum*
 DD. The staminodium with 1 protuberance.
 E. Margins of staminodium flat; petals flat or but slightly undulate on margins.
 F. Petals dilated; staminodium obcordate.
 G. Ovary white-villous; petals much dilated, the upper part almost orbicular..... 18. *villosum*
 GG. Ovary purple hairy.
 H. Staminodium pilose above.
 I. Dorsal sepal much larger than lower sepals..... 19. *insigne*
 II. Dorsal sepal about as long as lower sepals..... 20. *exul*
 HH. Staminodium glabrous..... 21. *Charlesworthii*
 FF. Petals elliptic; staminodium cordate..... 22. *Druryi*
 EE. Margin, the posterior, of staminodium revolute; petals strongly undulate on margin..... 23. *Spicerianum*
 CC. Staminodium lunate..... 24. *Fairleanum*
 BB. Lvs. netted or reticulated.
 C. Petals manifestly dilated above.
 D. Staminodium umbonate..... 25. *Appletonianum*
 DD. Staminodium not umbonate.
 E. Lvs. pale beneath, shorter than scape.
 F. Sepals not reticulated.
 G. Petals, the upper margin with warts; staminodium nearly rhomboid..... 26. *Bullenianum*
 GG. Petals without warts..... 27. *Volonteanum*
 FF. Sepals manifestly reticulated..... 28. *Hookerianum*
 EE. Lvs. violet-marbled beneath, about as long as scape..... 29. *venustum*
 CC. Petals not or but little dilated above.
 D. Margin of petals naked or ciliate, but without spots or warts.
 E. Sepal-nerve numerous, close.
 F. Front of lunate staminodium 2-lobed.
 G. Petals with upper margin naked..... 30. *tonsum*
 GG. Petals ciliate on both margins.
 H. Dorsal sepal obtuse..... 31. *Mastersianum*
 HH. Dorsal sepal acute or acuminate.
 I. Sinus of staminodium not 3-toothed; dorsal sepal ovate, acute..... 32. *virens*
 II. Sinus of staminodium 3-toothed; dorsal sepal nearly orbicular, long-acuminate..... 33. *javanicum*
 FF. Front of staminodium not 2-lobed, nearly orbicular..... 34. *Dayanum*
 EE. Sepal-nerve few, distant..... 35. *purpuratum*
 DD. Margin of petals with spots or warts bearing tufts of hairs.
 E. Petals somewhat falcate or deflexed, their upper surface marked with numerous spots or warts.
 F. Margin of petals with numerous approximate warts or spots.
 G. Lip longer than the petals, obliquely descending..... 36. *Curtisii*
 GG. Lip equaling or shorter than the petals, directly descending.
 H. Claw of the lip less than half as long as the sac..... 37. *ciliolare*
 HH. Claw of the lip half as long as the sac..... 38. *superbiens*
 FF. Margin of petals with few large warts..... 39. *Argus*
 EE. Petals sigmoid, or curved in two directions, their upper surface spotted or with few spots.
 F. Upper margin of petals only with warts.
 G. Lower sepal elliptic-ovate, obtuse; lobes of lip with small warts..... 40. *barbatum*
 GG. Lower sepal narrowly ovate, acute; lobes of lip with large warts..... 41. *callosum*
 FF. Upper and lower margins of petals with warts..... 42. *Lawrenceanum*
 11. *Parishii*, Pfitz. (*Cypripedium Parishii*, Reichb. f.). Lvs. oblong-ligulate, up to 16 in. long and 2½ in. wide, bright green: scape 4-8-fld., pale green, downy; fls. about 3 in. across; dorsal sepal oblong-elliptic, pale yellow, green-veined, the upper part bent forward, the basal lateral margins revolute; petals twisted, linear, 4-6 in. long, pendulous, the basal part green, with few blackish dots, the upper half blackish purple, pale-margined; lip deep green, often stained brown-purple;

staminodium pale yellow, green-mottled, obovate-oblong. Autumn. Moulmein. B.M. 5791. Gt. 47, p. 25. I.H. 22:214.

12. *Löwei*, Pfitz. (*Cypripedium Löwei*, Lindl.). Lvs. ligulate, up to 15 in. long; scape much exceeding lvs., nodding, 3-6 fld.; fls. 3-4 in. diam.; dorsal sepal oval, acute, yellowish green, veined with purplish brown at base, pubescent at the back; petals spatulate, twisted, about 3 in. long, deflexed, the basal part yellow, black-spotted, the upper part violet-purple; lip brown, paler beneath; staminodium obcordate, the border with purple hairs, a small erect hairy horn at the base. April and May. Borneo. F.S. 4:375. A.F. 11:1349. R.H. 1857, p. 402; 1883, p. 352; 1885, p. 473. Var. *cruciforme*, Hall. (*Cypripedium cruciforme*, Zoll. & Morr.). More slender, with narrower paler lvs. which are often obscurely marbled. W. Java.

13. *Haynaldianum*, Pfitz. (*Cypripedium Haynaldianum*, Reichb. f.). Lvs. up to 16 in. long and 2 in. broad; scape much exceeding lvs., long-hairy, 4-6 fld.; fls. 4 in. greatest diam.; dorsal sepal oval, obtuse, whitish tinted with rose above, the lower half with revolute margins pale yellowish green, with large brown spots; petals spatulate-linear, 3-4 in. long, twisted and recurved above, ciliate, yellowish green below with large brown spots, the upper half pale dull purple; lip pale green, tinged with dull purple; staminodium oblong, 2-lobed in front. Jan.-May. Philippine Is. B.M. 6296.

14. *Victoria-Mariae*, Rolfe (*Cypripedium Victoria-Mariae*, Rolfe). Lvs. broadly linear-oblong, paler beneath; scape several-fld., much exceeding lvs., brown, pubescent; fls. about 4 in. greatest diam.; dorsal sepal nearly orbicular, concave, the margin reflexed, white-ciliate; petals about $1\frac{1}{4}$ in. long, spreading, linear-lanceolate, twisted, white-ciliate, green, red-margined; lip about as long as petals, purple, green-margined; staminodium rhomboid-ovate. Sumatra. B.M. 7573.

15. *Chamberlainianum*, Pfitz. (*Cypripedium Chamberlainianum*, O'Brien). Lvs. up to 1 ft. long and $1\frac{1}{2}$ in. wide, narrowly white-margined; scape much exceeding lvs., several-fld., grayish brown, densely pilose, nodding; fls. about 4 in. greatest diam.; dorsal sepal almost orbicular, emarginate, the basal margin reflexed, white-ciliate, green, suffused with brown at base, the curved nerves brown; petals about $1\frac{1}{4}$ in. long, linear, spreading, twisted, long-ciliate, green, marked with small purple spots in lines along the nerves; lip about as long as sepals, pale green, with many violet dots. Sumatra. B.M. 7578. R.H. 1892, pp. 104, 105. G.F. 5:413. Gn.W. 8:641. G.W. 6, p. 471. R.B. 26:253.

16. *glaucohyllum*, J. J. Smith. Lvs. glaucous, broadly strap-shaped; scape many-fld.; dorsal sepal orbicular-ovate; petals linear, twisted, ciliate, red-dotted; lip large, violet; staminodium large, ovate, black-violet. Java. B.M. 8084.

17. *hirsutissimum*, Pfitz. (*Cypripedium hirsutissimum*, Lindl.). Lvs. narrowly strap-shaped, up to 6 in. long and $\frac{3}{4}$ in. wide, indistinctly marbled; scape shorter than the lvs., black-purple, hirsute, 1-fld.; fls. 4-5 in. greatest diam.; dorsal sepal nearly orbicular, the base and central part marked with blackish purple, often confluent dots, the remainder green; petals about 3 in. long, broadly spatulate, spreading, somewhat twisted, the margin undulate, the base marked with deep purple on a green ground and studded with many black hairs, the upper bright violet-purple; lip dull green, purple-stained and with minute blackish warts; staminodium almost square, with 3 protuberances and 2 white eyes. March-May. Assam. B.M. 4990. J.H. III. 52:513. R.H. 1859, pp. 182, 183. I.H. 4, p. 67 (note). F.S. 14:1430.

18. *villosum*, Pfitz. (*Cypripedium villosum*, Lindl.). Lvs. up to 18 in. long and $1\frac{1}{2}$ in. broad, grass-green,

with the lower surface paler and purple-spotted toward the base; scape nearly as long as lvs., 1-fld., hairy; fls. 5-6 in. greatest diam., glossy, the sepals and petals ciliate; dorsal sepal broadly oval, green, the base and center marked with brown-purple, the margin with a narrow white band, the basal margins revolute; petals about 3 in. long, strongly dilated above, yellow-brown, undulate, purple-hairy at the base, the midvein brown-purple; lip brownish yellow, the broad infolded lobes tawny yellow; staminodium tawny yellow, oblong-cordate. Jan., Feb. Moulmein. I.H. 4:126. A.F. 6:555. Gn. 65, p. 435. Var. *Bözellii*, Veitch (*Cypripedium Bözellii*, Reichb. f. *P. Bözellii*, Pfitz.). Dorsal sepal narrower at base, the central part marked with numerous, often confluent, black spots, the marginal band broader. Moulmein. I.H. 26:345. G.W. 5, p. 545. Gng. 15:306. Other varieties are: var. *albomarginatum*, Pfitz., the white margin of dorsal sepal broader; var. *atratum*, Pfitz. (also known as var. *Bözellii atratum*), has the dorsal sepal strongly marked with black spots and the white border broad, the petals yellow-brown above, spotted below, and yellow-margined (R. II. 1:8); var. *atrum*, Pfitz., dorsal sepal lemon-yellow, strongly black-spotted, the petals above red-lined; var. *canariense*, Pfitz., fls. with a general yellow tinge; var. *gigantum*, Pfitz., in color much like var. *aureum*, the petals and dorsal sepals larger; var. *Görtonii*, Pfitz., dorsal sepal with a narrow purple band, bright emerald, the petals pale rose-purple narrowly bordered with greenish black; var. *Lindenii*, Pfitz., fls. larger and more brilliant; var. *Measuresianum*, Pfitz., in color resembling var. *atratum*, the dorsal sepal yellowish green with a purple base, the lip pale cream; var. *Moënsii*, Pfitz., dorsal sepal black for two-thirds its height, then olive-green bordered with pale cream, the petals reticulated, the staminodium large, the protuberance amethyst.

19. *insigne*, Pfitz. (*Cypripedium insigne*, Wall.). Lvs. linear, up to 1 ft. long and $\frac{3}{4}$ in. broad, pale green; scape usually shorter than lvs., 1-, rarely 2-fld., densely purple-pubescent; fls. 4-5 in. greatest diam., glossy; dorsal sepal broadly oval, with margins somewhat revolute, the base and central portion apple-green, marked with numerous brown-purple spots along the green veins, the upper part white; petals linear-oblong, spreading, undulate, pale yellow-green veined brown-purple; lip yellowish green, brown-shaded; staminodium nearly quadrate, pubescent, the tubercle orange-yellow. Winter. Nepal to Assam. B.M. 3412. G.C. III. 18:763. A.F. 7:633. F.E. 9:327. Gng. 1:243. A.G. 16:73; 19:825. J.H. III. 42:47. C.L.A. 11:43. Gn. 65, p. 101; 72, p. 40.—Extremely variable in coloration, the following being some of the prominent varieties. Var. *albens*, Pfitz. Fls. soft greenish yellow, with the dorsal sepal pure white in upper half. Var. *albomarginatum*, Pfitz. Fls. yellowish; dorsal sepal white-bordered on entire margin, the light-colored spots only on the green portion. Nepal. Var. *Amesianum*, Pfitz. Fls. rather large, not spotted, resembling those of var. *Maulei*; dorsal sepal with a broad white margin, the green part suffused with brown. Var. *amœnum*, Pfitz. Dorsal sepal olive-green, marked with large brown spots, and widely bordered with white, with violet spots in the lower part of the border; petals olive-green, suffused with brown; lip clear maroon-brown. Khasia. Var. *apiculatum*, Hort. Var. *Arnoldianum*, Pfitz. Fls. larger than in var. *Maulei*; dorsal sepal greenish yellow, broadly white-margined, the spots confined to the green part. G.F. 7:425. A.F. 6:115. Var. *atrum*, Pfitz. Dorsal sepal yellow below; petals and lip clear yellow-brown. Var. *Breevesianum*, Hort. Dorsal sepal oblong, the lower two-thirds yellowish green, with brown dots in regular lines, the remainder white; petals reddish brown. Var. *Bröwnii*, Pfitz. Fls. large, pale green; dorsal sepal strongly marked with large pustules, each with a white dent at the apex; petals spotted. A.F. 7:65. Var. *brugénse*, Hort. Var. *Chantini*, Pfitz. One of the best

varieties; dorsal sepal large, olive-green below heavily spotted with brown, the upper part only white with a few large mauve spots; lip mahogany, polished. Nepal. R.H. 1878:130. G. 25:60. Var. *citrinum*, Pfitz. Fls. clear citron-yellow, except dorsal sepal, which is clear green at base, bordered with white and some clear mauve spots. Var. *corrugatum*, Pfitz. Lip corrugated. Var. *Colsonianum*, Pfitz. Fl. large, with a broad dorsal sepal. Var. *Cowperianum*, Pfitz. Fls. greenish yellow; dorsal sepal like that of var. *albo-marginatum*, spotted at base; petals larger; lip large. Var. *Cuhingianum*, Pfitz. Fls. large, clear green; dorsal sepal broad, the upper part white, with numerous clear violet spots. Var. *Dormanianum*, Hort. Var. *Dorothy*. Fls. yellow, in form like those of var. *Chantini*. Var. *Dowinianum*, Hort. Var. *Ernestii*, Pfitz. In form and color resembling var. *Sanderæ*, but the spots on dorsal sepal more distinctly defined. Var. *Eyermannii*, Hort. Resembles var. *Sanderæ*: fls. clear greenish yellow, the dorsal sepal with a few indistinct small spots, the upper part white. Var. *Eyermannianum*—var. *Eyermannii*. Var. *Förstermanii*, Pfitz. Dorsal sepal with a broad white border; petals distinctly brown-veined. Nepal. Var. *fuscatum*, Pfitz. R.B. 20:25. Var. *Gilmoreanum*, Pfitz. Fls. large, resembling those of var. *Chantini*; dorsal sepal very broad, bordered white, with large brown spots in the center and smaller ones toward the border. Var. *gracile*, Pfitz. Dorsal sepal narrow, yellowish green, irregularly brown-spotted, white border broad. Var. *Gravesianum*, Pfitz. Fls. on a long peduncle; dorsal sepal with a broad white border and numerous brown spots arranged in regular lines. Var. *guttatum*, Hort. R.H. 1851:201. Var. *Hallianum*, Pfitz. Sepals longer and broader than usual. Var. *Harefield Hall*, Hort. A fine variety, with large fls.; dorsal sepal large and round, with a broad white margin and large bright brown spots. Var. *Horsmanianum*, Pfitz. Dorsal sepal cuneate-oblong, with the entire upper portion white. Var. *Hurrellianum*, Hort. Dorsal sepal greenish yellow, the basal half suffused with reddish brown, the apex white. Var. *illustre*, Pfitz. Fls. yellowish, the sepals and petals spotted. Var. *Kimballianum*, Pfitz. Sepal more than 3 times longer than broad, flat, yellowish green, the spots running in lines into the white border; petals strongly veined. Khasia. Var. *Lageræ*, Hort. Dorsal sepal with a dark brown center, slightly suffused at edges with greenish yellow, with 4 or 5 pink marks, the whole margined with pure white. Var. *Laura Kimball*, Hort. Fls. resembling those of var. *Sanderæ*, but of a chamois-yellow, with a few brown hairs at the base of the petals. Var. *longisepalum*, Pfitz. Dorsal sepal very long and narrow, appearing narrower on account of its reflexed margins, pale green slightly tinted and veined brown at base, spotless, with a small white apex. Var. *Lütcianii*, Pfitz. Fls. bright yellow, tinted green, dorsal sepal clear green at base, with only 2 or 3 large dots of bronzy yellow, white border very broad. Var. *luteo-album*, Hort. Upper two-thirds of dorsal sepal pure white, remainder yellowish green with few spots. Var. *Lutchwyche-*



anum, Pfitz. Dorsal sepal narrower basal margins wavy, the upper white passing into pale yellow, spots hardly visible. Var. *Macfarlanei*, Pfitz. Fls. clear yellow; dorsal sepal with a broad white border, but without the usual pustules. Var. *Mandevilleanum*, Pfitz. Resembles var. *albo-marginatum*: petals with numerous spots in regular lines. Var. *Mahlei*, Pfitz. Dorsal sepal with the white predominant, extending to the base on either side of the green center, the upper spots violet-purple, the others larger and brownish. Nepal. G.W. 6, p. 470. Var. *maximum*, Pfitz. Dorsal sepal deep green, large. Var. *montanum*, Pfitz. Dorsal sepal with a narrow yellow line, the lower three-fourths of a golden yellow, with a brownish tinge due to the large spots; petals yellow, striated with brown-red. Var. *Mooreanum*, Pfitz. Fls. pale yellow, petals pale greenish yellow; dorsal sepal broad-ovate, with a broad white margin; central spots largest, smaller toward the margin; petals brown-veined. Nepal. Var. *Nilsonii*, Pfitz. Lip small, round. Var. *punctatissimum*, Hort. Dorsal sepal entirely covered with brown spots except a narrow white margin. Var. *Sänderæ*, Pfitz. Fig. 2757. Lvs. and scape pale: dorsal sepal primrose-yellow with a few minute reddish brown dots, the upper part white; petals yellow; lip waxy yellow. Gng. 7:196. A.G. 21:329. Gt. 56:1559. Var. *Sanderianum*, Pfitz. Fls. yellowish green, reticulated with darker green nerves, the dorsal sepal with a broad white border. Var. *Studyanum*, Hort. Var. *superbiens*, Hort. Var. *syhetense*, Pfitz. Dorsal sepal with large dark spots somewhat confluent in lines along the middle.

20. *exul*, Pfitz. (*Cypripedium exul*, O'Brien). Lvs. up to 8 in. long and nearly 1 in. broad, narrowly strap-shaped, lightly marbled, very narrowly white-margined: scape longer than lvs., green, purple-hairy, 1-fl.; fls. about 3 in. greatest diam.; dorsal sepal broadly ovate, obtuse, reticulate-veined, yellowish green with a white margin, brown-spotted; petals longer than the sepals, oblong, a little dilated toward the apex, ciliate, yellow sparsely spotted and lined with brown; lip marked like petals. Siam. C.O. pl. 13. B.M. 7510.

21. *Charlesworthii*, Pfitz. (*Cypripedium Charlesworthii*, Rolfe). Lvs. spotted, up to 10 in. long and 1 in. broad: scape 1-fl., about as long as lvs., purple-spotted, pubescent; fls. about 3 in. greatest diam.; dorsal sepal broadly ovate, large, about 2½ in. long, obtuse, nearly flat, white, mottled and suffused with pale carmine or purple-rose; petals horizontally spreading, a little shorter than sepal, oblong, obtuse, long-hairy at base on inner surface, sparsely ciliate, yellowish green, striated or reticulated with brown. Autumn. Bengal. B.M. 7416. R.B. 20:241. Gn. 47:252. A.F. 13:430. J.H. III. 45:469. O.R. 1:335. L. 10:443. A.G. 25:561.—Variable. The following varieties are known: Var. *conchiflorum*, Pfitz. Dorsal sepal concave. Var. *Crashawæ*, Pfitz. (*Cypripedium Crashawæ*, O'Brien) Has the fleshy lvs. glaucous beneath, the fls. larger. Var. *Desmetianum*, Pfitz. Dorsal sepal with the rose-veined white center surrounded by a band of rose-magenta, and with a white border. Var. *Duvivierianum*, Pfitz. Dorsal sepal orbicular, nearly 3 in. diam., pure white at the base, the radiating nerves of a rose-lilac, the mahogany petals tessellated with amber, the staminodium white with a chrome-yellow umbo. Var. *magnificum*, Pfitz. Fls. very large and brilliantly colored. Var. *marginatum*, Pfitz. Dorsal sepal is white with the base and border rose. Var. *unicolor*, Pfitz. Lip the same color as sepals and petals.

22. *Druryi*, Pfitz. (*Cypripedium Druryi*, Bedd.). Lvs. ligulate, up to 8 in. long and 1½ in. wide, lightly marbled: scape longer than lvs., purple-hairy, 1-fl.; fls. about 3 in. greatest diam.; dorsal sepal about 1½ in. long, rhombic-ovate, obtuse, nearly flat, glandular-black-hairy on the back, white-ciliate, yellowish green or citron-color, marked black-purple in center; petals

longer than sepals, narrowly elliptic, obtuse, somewhat falcate, pubescent on back, the face manifestly hairy at base, golden yellow, purple-lined down middle and brown-dotted at the base; lip about as long as petals, yellow. May, June. Travancore. I. H. 24:265. A.F. 6:555. F.M. 1880:425. L. 6. O. 1914, p. 139.

23. *Spicerianum*, Pfitz. (*Cypripedium Spicerianum*, Reichb. f.). Lvs. up to 1 ft. long, and 2 in. broad, broadly linear-lanceolate, pale beneath: scape about as long as lvs., glabrous, black-purple, 1-fl.; fls. about 3 in. greatest diam.; dorsal sepal transversely elliptic when spread out, about $1\frac{1}{2}$ in. long, deeply sulcate, the margins strongly retroflexed, giving the sepal the appearance of a spathe, white, a crimson-purple band down the center, and a large green basal blotch speckled with red; petals a little longer than sepal, spreading, deflexed, somewhat falcate, oblong, strongly undulate at margin, pilose at base on inner surface, green, dotted and suffused with brown; lip longer than sepal, the claw green, the pouch violet, pale-green-margined. Oct.-Dec. Assam. B.M. 6490. I.H. 30:473. Gn. 48, p. 304. A.G. 11:159. A.F. 3:226. Gng. 1:242. F.E. 9:329. G.W. 14, p. 73. J.H. III. 44:27.—Quite variable. Among others, are the following varieties: Var. *alboviride*, Pfitz. Differs in absence of median color of the dorsal sepal. Var. *grandiflorum*, Hort. Fls. larger than usual. Var. *leodiense*, Pfitz. Dorsal sepal for upper three-fourths pure white, with tender green at base, the petals green at the very undulate margins, with the center brownish green, the lip bronzy green. Var. *magnificum*, Pfitz. Lower sepal pure white. Var. *Mercatellianum*, Pfitz. Fls. yellowish white marked with purple, green absent. Var. *nānum*, Pfitz. Dorsal sepal without green basal spot. Var. *nigréscens*, Pfitz. Fls. smaller, lip blackish brown. Var. *rubescens*, Pfitz. Dorsal sepal pure white on back, strongly tinted with violet-red on face and marked down the center with a purple band, the petals bronzy green, marked with brown dots.

24. *Fairieanum*, Pfitz. (*Cypripedium Fairieanum*, Lindl.). Lvs. up to 6 in. long and 1 in. broad, strap-shaped, light green, paler beneath: scape much exceeding lvs., green, hairy, 1-fl.; fls. about 3 in. greatest diam.; dorsal sepal nearly orbicular, about $1\frac{1}{2}$ in. long, the basal margin somewhat reflexed and undulate, reticulated at the recurved apex, ciliate, pubescent on back, greenish white, striated and reticulated with violet; petals lanceolate, undulate on the ciliate margin, green, striated with violet; lip a little shorter than the sepal, white at base, green at apex. Autumn. Bhotan. G.C. III. 38:168. J.H. III. 51:321. Gn.M. 3:63. B.M. 5024. F.S. 12:1244. O. 1915, p. 15.

25. *Appletonianum*, Rolfe (*Cypripedium Appletonianum*, Gower. *C. Bullenianum Appletonianum*, Rolfe). Lvs. ligulate, indistinctly tessellated: scape much exceeding lvs., slender, velutinous, 1-fl.; fls. about 4 in. greatest diam.; dorsal sepal ovate, shortly acuminate, the margin at apex involute, the basal margin revolute, yellowish green, brown-striated; petals half longer than sepal, horizontally spreading, somewhat rhombic-dilated above, glabrous, the margins at base undulate, the upper margin usually with a few warts, the lower part green, purple-dotted, the upper part rose; lip green, marked with purple. Siam. O.R. 4:17. C.O. 22. Var. *Poyntzianum*, Pfitz. (*Cypripedium Poyntzianum*, O'Brien). Petals pale green, the apex lilac; lip whitish, rose at base, purple-spotted within. Siam.

26. *Bullenianum*, Pfitz. (*Cypripedium Bullenianum*, Reichb. f. *C. Hodkeræ Bullenianum*, Veitch). Lvs. up to 8 in. long, about 1 in. wide, tessellated: scape much exceeding lvs., 1-fl., hirsute; fls. about $3\frac{1}{2}$ in. greatest diam.; dorsal sepal ovate, acuminate, the basal margins reflexed, about $1\frac{1}{4}$ in. long, olive-green, shaded with brown; petals deflexed, dilated from a narrowly oblong base, obtuse at apex, ciliate, the upper margin with

hairless violet-brown warts, olive-green at base, rose-violet above; lip green, marked with greenish brown, longer than sepals but shorter than petals, the inflexed lobes with warts. March and April. Borneo. Var. *anophthalmum*, Reichb. f. Petals not spotted; lip green. Var. *oculatum*, Reichb. f. Claw of the lip ochre-color, brown-spotted; lip red-brown, bordered with green.

27. *Volonteianum*, Pfitz. (*Cypripedium Volonteianum*, Sand. *C. Hodkeræ Volonteianum*, Rolfe. *P. Hodkeræ Volonteianum*, Kerch.). Fig. 2758. Lvs. up to 8 in. long, 2 in. broad, obscurely tessellated above, paler beneath: scape much exceeding lvs., 1-fl., pale brown with white hairs; fls. about 4 in. greatest diam.; dorsal sepal ovate, long-acuminate, ciliate, the basal margins reflexed, yellowish green; petals nearly twice as long as sepals, deflexed, the narrow base undulate, spatulate and somewhat falcate, long-acuminate at apex, minutely toothed, at the base long-ciliate and barbed, green, rose at apex, upper margin with black spots; lip pale green, suffused rose. June, July. Borneo. Var. *gigantæum*, Pfitz. A robust form. Var. *Löwei*, Pfitz. Darker.

28. *Hodkeræ*, Pfitz. (*Cypripedium Hodkeræ*, Reichb. f. *C. barbatum Hodkeræ*, Hort.). Lvs. up to 6 in. long, and 2 in. wide, dark green, tessellated: scape 1-fl., much exceeding lvs., purple, pilose; fls. about 4 in. greatest diam.; dorsal sepal ovate, acuminate, pubescent on back, ciliate, yellowish white, marked centrally with green; petals depressed, spatulate, ciliate, the undulate basal part green with blackish spots, the margin purple, the apex purple; lip pale green, suffused with rose, the infolded lobes yellowish brown, purple-spotted. May and June. Borneo. B.M. 5362. F.S. 15:1565.—The following varieties are known: *cærulescens*, *luteum*, *majus*, *Measuresianum*, and *superbiens*.

29. *venustum*, Pfitz. (*Cypripedium venustum*, Wall.). Lvs. up to 6 in. long and $1\frac{1}{2}$ in. wide, above dark green blotched with pale grayish green, beneath strongly violet-mottled: scape about as long as lvs., 1-fl., purple, pubescent; fls. about 3 in. greatest diam.; dorsal sepal broadly ovate, acute, white, veined green; petals somewhat spatulate, spreading, ciliate, longer than sepals, barbed at base, the basal part green with blackish warts, the upper portion brownish dull purple; lip pale yellowish green, rose-tinged, reticulated with green, the infolded lobes yellow. Jan.-March. N. India. B.M. 2129. B.R. 788. Var. *Measuresianum*, Pfitz. Fls. white and green, without the brown or red tinge. Var. *pardinum*, Pfitz. (*Cypripedium pardinum*, Reichb. f. *P. pardinum*, Pfitz.). Warts extending over whole upper surface of the petals which are yellow, suffused with copper-color; inflexed lobes of lip with large conic warts. F.M. 51. Var. *spectabile*, Pfitz. Scape shorter than in the type, the petals strongly colored with mahogany at the apex, the middle area brownish, irregularly black-spotted, the lip large, bronzy green, reticulated with clear green.

30. *tónsum*, Pfitz. (*Cypripedium tónsum*, Reichb. f.). Lvs. up to 8 in. long and 2 in. wide, tessellated, usually beneath toward the base with purple: scape longer than lvs., 1-fl., reddish brown, shortly pilose; fls. 4-5 in. greatest diam., shining; dorsal sepal broadly ovate, acute, ciliolate, white, green-veined, or the alternate shorter veins sometimes purplish; petals somewhat spatulate, pale green, sometimes stained with dull purple, green-veined, marked with a few black spots;



2758. *Paphiopedilum Volonteianum*. ($\times \frac{1}{4}$)

lip dull green, tinged crimson and brown, the infolded lobes broad, warty. Autumn. Mountains of Sumatra. C.O. *Cypripedium* 6. The following varieties are known: *cupreum*; *superbiens*, with the dorsal sepal white at the extremity marked with clear brown; and *superbum*.

31. *Mastersianum*, Pfitz. (*Cypripedium Mastersianum*, Reichb. f.). Lvs. up to 10 in. long and 2 in. broad, deep green, tessellated: scape longer than lvs., 1-flid., brown-purple-long-hirsute; fls. 3-4 in. greatest diam.; dorsal sepal nearly orbicular, ciliate, bright green, the border yellowish white, green-veined; petals horizontal, ciliate, obtuse, brownish red, the base paler with numerous blackish purple small warts on the upper margin and midvein; lip pale reddish brown, the infolded lobes spotted dull purple on a greenish brown ground. Spring. Amboina. G.C. III. 15:593; 25:274. B. M. 7629. O. 1910, p. 88.

32. *virens*, Pfitz. (*Cypripedium virens*, Reichb. f. *C. javanicum virens*, Veitch. *P. javanicum virens*, Kerch.). Lvs. up to 6 in. long and 2 in. wide, obscurely tessellated above: scape somewhat exceeding lvs., brown, shortly pilose, 1-flid.; fls. 3-4 in. greatest diam.; dorsal sepal ovate, acute, ciliate, the margin reflexed at base, about 1½ in. long, pale green, striated darker green; petals divaricately spreading, longer than dorsal sepal, obtuse, green at base with scattered small, black warts, the apex pale purple; lip about as long as sepal, green suffused with rose, the inflexed lobes with numerous contiguous small warts. N. Borneo.

33. *javanicum*, Pfitz. (*Cypripedium javanicum*, Reinw.). Lvs. up to 7 in. long and 2 in. wide, distinctly tessellated above, pale green beneath: scape longer than lvs., pubescent, 1-flid.; fls. 3-4 in. greatest diam.; dorsal sepal nearly orbicular, long-acuminate, ciliate, margin reflexed below, pale green, striated darker green; petals somewhat deflexed and falcate, oblong, obtuse, ciliate, green, the inner surface with brown small warts; lip green, the inflexed lobes minutely warty. Java. F.S. 7:703. Var. *majus*, Du Buyss. Fls. larger and greener. Var. *minus*, Pfitz. Fls. smaller. Var. *superbum*, Hort.

34. *Dayanum*, Pfitz. (*Cypripedium Dayanum*, Reichb. f. *C. spectabile Dayanum*, Lindl. *C. superbiens Dayanum*, Reichb. f.). Lvs. up to 7 in. long and 2 in. wide, distinctly tessellated: scape much longer than lvs., purple, pilose, 1-flid.; fls. 4-6 in. greatest diam.; dorsal sepal broadly ovate, acuminate, ciliate, white, green-veined; petals ligulate, somewhat deflexed, long-ciliate with black hairs, greenish brown at base, rose-purple above; lip brownish purple, green-veined, the infolded lobes with numerous small purple warts. May, June. Borneo. F.S. 15:1527. Var. *Ernestianum*, Pfitz. Petals crimson-veined at base, the apex white and ciliate with purple hairs. Var. *Pétri*, Pfitz. (*Cypripedium Pétri*, Reichb. f.). Dorsal sepal long-triangular acute, the petals somewhat broadened above, the lip more conical. Var. *Smithianum*, Pfitz. Var. *spléndens*, Pfitz. Fls. more brilliant in color. Var. *superbum*, Pfitz., has the petals maroon in the center, lined with green, the lip maroon veined with greenish brown.

35. *purpuratum*, Pfitz. (*Cypripedium purpuratum*, Lindl. *P. sinicum*, Hance). Lvs. up to 5 in. long and 1½ in. wide, distinctly tessellated, paler beneath: scape longer than lvs., 1-flid., purple, hirsute; fls. 3-3½ in. greatest diam.; dorsal sepal nearly orbicular, abruptly acute, folded at the middle, the basal margins revolute, white with a greenish central stain, purple-veined, ciliate; petals spreading, undulate, narrowly elliptic, somewhat falcate, ciliate with mixed longer and shorter hairs, purplish crimson, with purple or green veins, numerous small blackish warts at base; lip brownish purple, deeper veined and reticulated, infolded purple lobes with numerous warts. Autumn. Hong-Kong. B.M. 4901. F.S. 11:1158. C.O. *Cypripedium* 12. Vars. *Kimballianum* and *Seegeri* are known.

36. *Curtisii*, Pfitz. (*Cypripedium Curtisii*, Reichb. f.). Lvs. up to 8 in. long, tessellated above: scape longer than lvs., 1-flid., pubescent; fls. 3-4 in. diam., the segms. ciliate; dorsal sepal broadly ovate, acuminate, grass-green, white-margined, the numerous green veins purple toward the base; petals ligulate, deflexed, the tips recurved, the margin with black hairs and warts, pale purple, white along the midvein, uniformly purple-spotted, green-veined; lip helmet-shaped, brownish purple, the infolded narrow purple lobes with darker warts. May, June. Sumatra. A.F. 6:557. Gng. 1:41. L. 3:140. Var. *amœnum*, Pfitz. Dorsal sepal brown at base with a broad white margin; petals green toward apex. Var. *pallidum*, Pfitz. Fls. more delicately colored; petals almost white at apex, strongly dotted with clear purple; lip pale greenish, lightly tinted pale brown-purple.

37. *ciliolære*, Pfitz. (*Cypripedium ciliolære*, Reichb. f.). Lvs. obtuse, oblong-elliptic, 6-8 in. long, tessellated: scape longer than lvs., 1-flid., hirsute, black-brown; fls. 4 in. greatest diam.; dorsal sepal broadly ovate, acuminate, ciliate, white, purple at the base, green-veined, or the lateral veins sometimes purple; petals deflexed, recurved, ciliate with long black hairs, green toward base with numerous blackish warts, pale purple at apex; lip manifest, helmet-shaped, dull brownish purple, the pale yellow-green infolded lobes with purple warts. April-July. Malay Archipelago and Philippines. I.H. 31:530. G.C. III. 21:348. Var. *Miteaunum*, Pfitz. Dorsal sepal nearly triangular, reddish crimson at base and strongly black-nerved, the border white, lightly tinted rose; petals crimson at base, dotted with blackish brown. L. 3:146. Other varieties are: *Elmireanum*, *grandiflorum*, *magnificum*, *maximum*, *spléndens*, and *spléndidum*.

38. *superbiens*, Pfitz. (*Cypripedium superbiens*, Reichb. f. *C. barbatum* var. *Veitchii*, Linn. *C. barbatum* var. *superbiens*, Morr. *C. Veitchianum*, Hort.). Lvs. up to 8 in. long and 2½ in. broad, oblong-elliptic, tessellated: scape longer than lvs., brown, white-pilose, 1-flid.; fls. about 4 in. greatest diam., the segms. ciliate; dorsal sepal broadly ovate, acute, white, green-striped; petals deflexed, ligulate, white, green-veined, with numerous blackish warts, the marginal ones larger; lip somewhat helmet-shaped, brownish purple, pale green below, the infolded lobes crimson and warty. May-July. Malay Peninsula. I.H. 12:429. F.S. 19:1996. A.F. 7:707. R.H. 1871, p. 596. J.H. III. 50:3. F.W. 1872: 33.—Vars. *Démidoffii* and *Lindenii* are known.

39. *Argus*, Pfitz. (*Cypripedium Argus*, Reichb. f. *C. barbatum* var. *Argus*, Hort. *C. Pücherianum*, Manda). Lvs. acute, up to 8 in. long and 1½ in. wide, tessellated: scape longer than lvs., brown-hairy, 1- or rarely 2-flid.; fls. 2½-3 in. greatest diam.; dorsal sepal broadly ovate, acute, ciliate, white, the base rarely spotted blackish purple, green-veined, or the longer veins sometimes purple; petals undulate, ligulate, deflexed, acute, ciliate, white, the veins pale green, the upper third pale purple, the inner surface with blackish warts; lip dull brownish purple, pale greenish brown beneath, the narrow infolded lobes pale purple, deeper spotted. March, April. Luzon. B.M. 6175. F.M. 1876:220. B.H. 32:241. R. 2:83. C.O. 5. A.F. 3:179. Var. *Boddartii*, Pfitz. Petals narrower and more strongly deflexed. Var. *Lindenii*, Pfitz. Colors brighter; dorsal sepal larger. Var. *Moënsii*, Pfitz. (*Cypripedium Moënsianum*, Hort.). Dorsal sepal very large, pointed, white, green-lined; petals broader, white, green-lined, strongly spotted with blackish crimson, the spots confluent in transverse masses; lip greenish yellow below, maroon above. L. 3:129. Var. *nigricans*, Pfitz. Spots congested and confluent. Var. *nigro-maculatum*, Pfitz. Dorsal sepal white, lightly tinted rose, dotted reddish brown at base; petals green at base, strongly black-spotted; lip maroon above, olive below. Var. *superbum*,

Pfütz. Dorsal sepal round, lightly acuminate, white, strongly veined with shining green, the border here and there spotted with reddish purple; petals white at base, green-lined, and almost entirely black-spotted; lip reticulated. Other varieties known are: *biflorum*, *gigantæum*, *grandiflorum*, *Mantiniæ*, *Morrenianum*, *multicolor*, *nigrum*, *purpuratum*, and *tigrinum*.

40. *barbatum*, Pfütz. (*Cypripedium barbatum*, Lindl. *C. purpuratum*, Wight). Lvs. acute, up to 6 in. long, tessellated: scape longer than lvs., black-purple, pubescent, 1- or rarely 2-fl.; fls. $2\frac{1}{2}$ -3 in. greatest diam.; dorsal sepal nearly orbicular, pointed, folded at the mid-vein, white, more or less purple-stained, green at base, the veins prominent, deep purple, the central green at base; petals spreading, somewhat deflexed, oblong-linear, ciliate, the upper margin with small blackish warts, the base brownish green, the apex purple; lip helmet-shaped, deep brownish purple, paler below, the infolded purple lobes deeper-spotted. June, July. Malay Peninsula. B. M. 4234. B. R. 27, p. 53 (desc.). F. S. 3:190. B. H. 33:7. V. O. 4:12. Var. *biflorum*, Pfütz. Scape 2-fl. Var. *cærulescens*, Pfütz. Dorsal sepal white and green in about equal proportions, the nerves dark green and crimson; petals olive-green, whitish rose at the apex with a few black dots; lip maroon. Var. *Crössii*, Pfütz. (*Cypripedium Crössii*, Hort. *C. barbatum* var. *Warnerianum*, Warn.). Dorsal sepal large, nearly round, the upper half pure white, the center green, striped deep maroon and tinted rose-purple between the nerves; petals strongly reflexed, rose-violet toward the apex which terminates with a white spot; lip clear maroon. B. H. 15:227. Var. *grandiflorum*, Pfütz. Dorsal sepal very large, the apex pure white, lined and veined with rose-purple at base; petals olive-green above, black-spotted, rose-magenta below toward the apex; lip large, deep purple-maroon. Var. *Hendersonii*, Pfütz. Dorsal sepal has a broad white border, the center shaded with violet, and the base lined with tender green; petals undulate, reflexed, the upper surface olive-green, the lower surface light rose heavily shaded green, the extremity with a white point; lip deep maroon. Var. *illustre*, Pfütz. Dorsal sepal round, acuminate, white, green-lined at base, banded with blackish purple, and broadly white-bordered; petals brownish green above, rose-salmon, below; lip very large, blackish brown. Var. *majus*, Pfütz. Resembles var. *grandiflorum*, but is more robust and has larger fls. of richer color. Var. *nanum*, Pfütz. Dorsal sepal small, only about 1 in. long; petals somewhat falcate, about $1\frac{1}{4}$ in. long, with 2-4 warts. Var. *nigrum*, Pfütz. (*Cypripedium nigrum*, Reichb. f.). Dorsal sepal oblong, acute; petals narrower. Perhaps



2759. *Paphiopedilum Lathamianum*. Hybrid. (See supplementary list.) ($\times\frac{1}{2}$)

a natural hybrid. Borneo. Var. *nigrum*, Pfütz. Dorsal sepal very large, oval, strongly lined with deep crimson and shaded violet-purple, the center greenish white, the border broad white; petals bronzy black above; lip blackish brown. A. F. 36:1184. Gng. 20:34. Var. *O'Brienii*, Pfütz. Dorsal sepal small, less than 1 in. long; petals falcate, with 6-8 warts. Var. *orbum*, Pfütz. (*Cypripedium orbum*, Reichb. f.). Fls. paler than in the type. Var. *porphyreum*, Pfütz. Dorsal sepal very broad, round, reticulated, reddish violet on a white ground, the border pure white; petals olive-green above, rose-violet below; lip very large, blackish brown. Var. *pulcherrimum*, Pfütz. Perhaps a natural hybrid between *P. Hookeræ* and *P. hirsutissimum*. Var. *superbum*, Pfütz. Dorsal sepal orbicular, very flat, striped with very deep crimson and black-veined; petals reddish wine-color above, and olive-brown below with a central black band. Var. *Warneri*, Pfütz. Dorsal sepal very broad, nearly orbicular, white, strongly lined with dark green, stained with red-magenta, with a broad white border; petals shining dark green above; lip deep maroon. Other varieties known are: *gigantæum*, *gracile*, *mosaicum*, *nobile*, *picatum*, *plumbeum*, *purpureum*.

41. *callidum*, Pfütz. (*Cypripedium callidum*, Reichb. f.). Lvs. acute, up to 10 in. long; tessellated: scape longer than lvs., brownish purple, 1-, or sometimes 2-fl.; fls. 4 in. greatest diam.; dorsal sepal broadly ovate, cordate, white, veins green at base, deep purple above, alternately longer and shorter; petals spreading, ligulate, pale green, tinted pale rose at apex, with 4 or 5 blackish warts on upper margin; lip helmet-shaped, brownish purple, the infolded lobes purple-spotted. Feb., March. Siam. R. H. 1888:252. L. 2:73. C. O. *Cypripedium* 7. Var. *gigantæum*, Pfütz. Dorsal sepal broad, white, shaded with emerald-green lined with deep green. Var. *Rossianum*, Pfütz. Petals longer, narrower, and strongly falcate. Var. *Sanderæ*, Pfütz. Fls. white, the dorsal sepal green-veined. C. O. *Cypripedium* 15a. Var. *Schmidtianum*, Pfütz. (*Cypripedium Schmidtianum*, Kranzl.). Petals at base deflexed; lobes of the lip inflexed, thickened, subacute at apex; staminodium less angled, nearly orbicular. Var. *sublæve*, Pfütz. Petals without warts or hairs on the surface. Var. *viridiflorum*, Pfütz. Dorsal sepal and petals greenish white, veined with deep gray.

42. *Lawrenceanum*, Pfütz. (*Cypripedium Lawrenceanum*, Reichb. f.). Lvs. up to 10 in. long, $2\frac{1}{2}$ in. broad, tessellated: scape longer than lvs., brownish purple, pubescent, 1-, or rarely 2-fl.; fls. 4-5 in. greatest diam.; dorsal sepal nearly orbicular, white, the veins alternately longer and shorter, deep purple, the central ones usually green at base; petals spreading, ciliate, ligulate, green, the tips purple, each margin with 5-10 blackish warts; lip dull purple, brown-tinged above, green beneath. April-July. B. M. 6432. I. H. 30:478. F. S. 23:2372. G. C. III. 21:291. G. Z. 24, p. 1. J. H. III. 51:51; 63:545. Var. *Abbottianum*, Pfütz. Fls. large, the dorsal sepal with veins deep crimson. Var. *atropurpureum*, Hort. Same as following. Var. *atrobrum*, Pfütz. Fls. richly colored, especially the dorsal sepal. Var. *biflorum*, Pfütz. Scape 2-fl., the lower fl. is normal, while the dorsal sepal of the upper fl. is reflexed. Var. *coloratum*, Pfütz. Dorsal sepal subacute, internerves pale violet, warts of the petals numerous. Var. *expansum*, Pfütz. Dorsal sepal much larger than in the type; petals larger. Var. *Grenieri*, Pfütz. Dorsal sepal very broad, round, emerald-green at base, with numerous deep blackish purple veins above, the ground-color white, shaded rosy magenta, the border white; petals emerald-green above, greenish white beneath, lined with rose; lip well developed, reddish maroon above, greenish yellow below. Var. *Hyeænum*, Pfütz. Dorsal sepal white, green-veined; petals horizontal, very long, white, green-dotted; lip olive. G. C. III. 21:37. Var. *magnificum*, Pfütz. Dorsal sepal deep

green at base, with a broad white border, lined with blackish purple at center. Var. *Moensii*, Pfütz. Dorsal sepal broad, strongly lined with blackish purple and carmine, the border pure white; petals sea-green; lip brownish maroon with a white terminal spot. Var. *pleiolethcum*, Pfütz. Dorsal sepal white above, the



2760. *Paphiopedilum Leeanum*. Hybrid. (See supplementary list). ($\times \frac{1}{4}$)

green veins short. Var. *stenosemum*, Pfütz. Dorsal sepal much narrower than in type, elliptic. Other varieties known are: *aureolum*, *giganteum*, *grande*, *Lindenii*, *marmoratum*, *nigrum*, *picum*, *Pücherianum*, *purpurascens*, *roseum*, *superbum*, *viridescens*.

The following list contains some of the hybrids. Many others are grown by fanciers but cannot be mentioned here. For catalogues of hybrids, see G.C. III. 17:199, A.G. 16:118, and the "Orchid Stud-book," by Rolfe & Hurst. *P. Acis*=*P. Lawrenceanum* \times *P. insigne* Maulei. *P. Acme*=*P. nitens* \times *P. Bessie K. Pitcher*. *P. Actaeus*=*P. insigne* \times *P. Leeanum*. *P. Actaeus Bianca*=*P. insigne* \times *P. Leeanum* \times *P. Prospero*. G.C. III. 44:261. *P. Actaeus langleyense*=*P. insigne* \times *P. Leeanum* \times *P. giganteum*. G.C. III. 41:12. *P. Adrastus*=*P. Leeanum* \times *P. Boxallii*. *P. Albertianum*=*P. insigne* \times *P. Spicerianum*. *P. Albert Truffaut*=*P. Harrisianum* \times *P. Spicerianum*. *P. Alcibiades magnificum*=*P. Leeanum* \times *P. Schlesingerianum*. G.M. 49:55. *P. Alcibiades superbum*=*P. Leeanum* \times *P. Mons. de Curte*. *P. Alcides*=*P. insigne* \times *P. hirsutissimum*. *P. Alector*=*P. barbatum* \times *P. Spicerianum*. *P. Alfred Hollington*=*P. ciliolare* \times *P. philippinense*. *P. Alice*=*P. Spicerianum* \times *P. Stonei*. *P. Allanidnum*=*P. Spicerianum* \times *P. Curtisii*. *P. Alnum*=*P. barbatum* \times *P. Lawrenceanum*. *P. Alson*=*P. insigne* \times *P. Druryi*. *P. Amandum*=*P. insigne* \times *P. venustum*. *P. Amesidnum*=*P. villosum* \times *P. venustum*. *P. Aphrodite*=*P. Lawrenceanum* \times *P. niveum*. *P. apiculatum*=*P. barbatum* \times *P. Boxallii*. *P. Arnoldii*=*P. bellatulum* \times *P. superciliale*. G. 31:165. *P. Artemis*=*P. Dayanum* \times *P. Swanianum*. *P. Arthuridnum*=*P. insigne* \times *P. Fairieanum*. A.F. 6:557. *P. Arthuridnum pulchellum*=*P. insigne* \times *P. Fairieanum*. *P. Ashburtonia*=*P. barbatum* \times *P. insigne*. I.H. 35:61. *P. Ashburtonia calosplum*=*P. barbatum* \times *P. insigne*. *P. Ashburtonia expandens*=preceding. *P. Ashworthii*=*P. insigne* \times *P. Spicerianum*. J.H. III. 55:481. *P. Aspasia*=*P. Selligerum* \times *P. tonsum*. *P. Astraea*=*P. philippinense* \times *P. Spicerianum*. *P. augustum*=*P. Haynaldianum* \times *P. villosum*. *P. aureum*=*P. nitens* \times *P. Spicerianum*. *P. aureum Hydanum*=preceding. G. 28:171. *P. aureum virgideum*=same. J.H. III. 62:71. *P. auroreum*=*P. Lawrenceanum* \times *P. venustum*. *P. Ballantinei*=*P. purpuratum* \times *P. Fairieanum*. *P. barbato-Masterii*=*P. Baron Schroeder*. *P. Fairieanum* \times *P. oenanthum*. *P. Bérétii*=*P. barbatum* \times *P. insigne* \times *P. Chantini*. *P. Beatrice*=*P. Boxallii* \times *P. Lowii*. *P. Beckmanii*=*P. bellatulum* \times *P. Boxallii*. *P. Berggrenidnum*=*P. Harrisianum* \times *P. insigne*. *P. Bessie K. Pitcher*=*P. Leeanum* \times *P. villosum*. *P. Bragaidnum*=*P. Boxallii* \times *P. hirsutissimum*. *P. Bridgeti*=*P. Argus* \times *P. Godseffianum*. G.M. 52:184. J.H. III. 58:229. *P. Brianii*=*P. philippinense* \times *P. tonsum*. *P. Buchananidnum*=*P. Druryi* \times *P. Spicerianum*. *P. calceolatum*=*P. barbatum* \times *P. Lowii*. *P. caligore*=*P. venustum* \times *P. Dayanum*. *P. callo-Rothschildianum*=*P. callosum* \times *P. Rothschildianum*. *P. Calypso*=*P. Boxallii* \times *P. Spicerianum*. *P. Cékhamii*=*P. villosum* \times *P. superbiens*. *P. Carnusidnum*=*P. Haynaldianum* \times *P. Spicerianum*. *P. Ceres*=*P. Spicerianum* \times *P. hirsutissimum*. *P. chelidense*=*P. Lowii* \times *P. barbatum*. *P. chloranthum*=*P. Harrisianum* \times *P. venustum*. *P. Cleopatra*=*P. oenanthum* \times *P. Hooker*. *P. Chinkaberridnum*=*P. philippinense* \times *P. Curtisii*. *P. Clothilde Moens*=*P. Leeanum* \times *P. Haynaldianum*. *P. Cölmansii nigrum*=*P. Harrisianum* \times *P. javanicum*. *P. conchidnum*=*P. Harrisianum* \times *P. purpuratum*. *P. conspicuum*=*P. Harrisianum* \times *P. villosum*. *P. Constantia*=*P. Curtisii* \times *P. Stonei*. *P. Cooksonidnum*=*P. Alnum*. *P. Creon*=*P. Harrisianum* \times *P.*

onanthum. *P. Crethus*=*P. Spicerianum* \times *P. Argus*. *P. Crossidnum*=*P. insigne* \times *P. venustum*. *P. Crossidnum pallidum*=*P. insigne* \times *P. venustum*. *P. pardinum*. *P. Crossidnum Tautidnum*=preceding. *P. Cybele*=*P. Lawrenceanum* \times *P. Druryi*. *P. Dauthieri*=*P. barbatum* \times *P. villosum*. *P. Doodmanidnum*=*P. Chamberlainianum* \times *P. Spicerianum*. *P. Dibdin*=*P. Boxallii* \times *P. Argus*. *P. dilatum*=*P. Boxallii* \times *P. hirsutissimum*. *P. discolor*=*P. venustum* \times *P. Harrisianum*. *P. Donatidnum*=*P. insigne* \times *P. Harrisianum*. *P. Donasteridnum*=*P. hirsutissimum* \times *P. callosum*. *P. Doris*=*P. venustum* \times *P. Stonei*. *P. Druryi-Hooker*=*P. Druryi* \times *P. Hooker*. *P. Duchess of Sutherland*=*P. Rothschildianum* \times *P. Youngianum*. *P. eboracum*=*P. insigne* \times *P. nitens*. J.H. III. 53:589. *P. Editha*=*P. bellatulum* \times *P. Charlesworthii*. *P. Eismannidnum*=*P. Boxallii* \times *P. Harrisianum*. *P. Electra*=*P. Harrisianum* \times *P. insigne*. *P. enfieldense*=*P. Lawrenceanum* \times *P. Hooker*. *P. Ephialtes*=*P. insigne* \times *P. Chantini*. *P. Euryandrum*=*P. barbatum* \times *P. Stonei*. G.Z. 24, p. 241. *P. Eurylochus*=*P. ciliolare* \times *P. hirsutissimum*. *P. Evelyn Ames*=*P. Calypso* \times *P. Leeanum* \times *P. giganteum*. *P. Excelsior*=*P. Rothschildianum* \times *P. Harrisianum*. *P. Fairy Queen*=*P. Curtisii* \times *P. Druryi*. *P. Finetidnum*=*P. philippinense* \times *P. ciliolare*. *P. Füchidnum*=*P. Bullenianum* \times *P. venustum*. *P. Fletcheridnum*=*P. Godefroy* \times *P. Mabelia*. G.C. III. 40:254. J.H. III. 53:339. *P. Fowleri*=*P. callosum* \times *P. Rothschildianum*. *P. Fräseri*=*P. barbatum* \times *P. hirsutissimum*. *P. Frau Ida Brandt*=*P. Io* \times *P. Youngianum*. *P. Galatea*=*P. Harrisianum* \times *P. insigne* \times *P. Maulei*. *P. Galatea majus*=*P. Harrisianum* \times *P. insigne*. J.H. III. 46:47. *P. Garret A. Hobart*=*P. Lathamianum* \times *P. insigne* \times *P. Chantini*. *P. Gaudidnum*=*P. Curtisii* \times *P. Harrisianum*. *P. gemmiferum*=*P. Hooker* \times *P. purpureum*. *P. Germindnum*=*P. villosum* \times *P. hirsutissimum*. *P. Gigas*=*P. Harrisianum* \times *P. Lawrenceanum*. *P. Godseffidnum*=*P. Boxallii* \times *P. hirsutissimum*. *P. Goweridnum*=*P. Lawrenceanum* \times *P. Curtisii*. *P. Goweridnum formidnum*=preceding. G.M. 43:78. *P. grande*=*P. Lawrenceanum* \times *P. villosum*. *P. grande atridnum*=preceding. *P. Gratizidnum*=*P. bellatulum* \times *P. enfieldense*. G.C. III. 37:77. *P. Grævesia*=*P. Argus* \times *P. niveum*. *P. Greydnum*=*P. Druryi* \times *P. ciliolare*. *P. Harlequin*=*P. Harrisianum* \times *P. barbatum* \times *P. villosum*. F.S. 22:2289, 2290. R.B. 22, p. 148. A.F. 6:557. *P. Harrisidnum Dauthieri*=*P. Dauthieri*. *P. Harrisidnum linedum*=*P. barbatum* \times *P. Boxallii*. *P. Harrisidnum Pücheridnum*=*P. Harrisidnum superbum*=*P. barbatum* \times *P. villosum*. *P. Harveidnum*=*P. Leeanum* \times *P. Stonei*. *P. Hephæstus*=*P. barbatum* \times *P. Lawrenceanum*. *P. Hera Mrs. Tautz*=*P. nitens* \times *P. Spicerianum*. *P. Hindidnum*=*P. Godefroy* \times *P. insigne*. G.C. III. 33:53. *P. Hinkidnum*=*P. Godefroy* \times *P. insigne*. *P. Höbomii*=*P. Lawrenceanum* \times *P. philippinense*. A.F. 14:1094. Gng. 7:242. *P. Holdbrook Gaskell*=*P. Leeanum* \times *P. Charlesworthii*. *P. Honoris*=*P. Druryi* \times *P. Godefroy*. *P. Hornidnum*=*P. Spicerianum* \times *P. superbiens*. *P. Hurrellidnum*=*P. Argus* \times *P. Curtisii*. *P. hybridum*=*P. villosum* \times *P. barbatum*. *P. Ianthe*=*P. Harrisianum* \times *P. venustum*. *P. Ingens*=*P. insigne* \times *P. Rothschildianum*. *P. Ino*=*P. Haynaldianum* \times *P. Canhamii*. *P. intermedium*=*P. hybridum*. *P. Io*=*P. Lawrenceanum* \times *P. Argus*. *P. James Garfield*=*P. regale* \times *P. tonsum*. *P. James K. Polk*=*P. Chamberlainianum* \times *P. nitens*. *P. javanico-Spicerianum*=*P. lutescens*. *P. javanico-superbiens*=*P. superbiens* \times *P. virens*. *P. Joseph Donat*=*P. Ashburtonia* \times *P. Spicerianum*. *P. Josephidnum*=*P. Druryi* \times *P. Sementa*. A.F. 7:707. *P. Juno*=*P. callosum* \times *P. Fairieanum*. *P. Kimballidnum*=*P. Rothschildianum* \times *P. Dayanum*. *P. Krameridnum*=*P. oenanthum* \times *P. villosum*. *P. Krishna*=*P. insigne* \times *P. tonsum*. *P. Ldforzadei*=*P. barbatum* \times *P. insigne* \times *P. Chantini*. *P. Lanieridnum*=*P. Lathamidnum* (Fig. 2759). *P. Spicerianum* \times *P. villosum*. O. 1910, p. 88. *P. Leander*=*P. Leeanum* \times *P. villosum*. *P. Lebaudidnum*=*P. hybridum*. *P. Haynaldianum* \times *P. philippinense*. A.G. 23:387. *P. Ledouzia*=*P. callosum* \times *P. Harrisianum*. *P. Leednum* (Fig. 2760)=*P. insigne* \times *P. Spicerianum*. Gng. 10:53. G. 25:112. F.R. 11:363. A.F. 16:1730; 35:108. *P. Leednum aureum*=*P. Leednum burfordiense*. *P. Leednum Chinkaberrydnum*. G.M. 52:1008. *P. Leednum giganteum*=*P. insigne* \times *P. Spicerianum*. A.F. 9:765. J.H. III. 64:29. *P. Leednum grandiflorum*=*P. Leednum lutescens*. *P. Leednum Maseredidnum*=*P. insigne* \times *P. Chantini*. *P. Spicerianum*. I. H. 36:77. A.F. 6:555. A.G. 12:65. *P. Leednum nigrescens*=*P. Leednum pulchellum*. *P. Leednum superbum* is a good form raised by Veitch. *P. Lloyd magnificum*=*P. bellatulum* \times *P. Swanianum*.



2761. *Paphiopedilum Niobe*. Hybrid. (See supplementary list). ($\times \frac{1}{4}$)

—*P. Lobengula*—*P. Boxallii* × *P. Harrisianum*.—*P. Loewegrenid-*
num—*P. Spicerianum* × *P. lo.*—*P. Lord Derby*—*P. Rothschild-*
ianum × *P. superbiens*.—*P. lûcidum*—*P. Lowii* × *P. villosum*.—*P.*
lûridum—*P. Lawrenceanum* × *P. villosum*.—*P. lûridum purpureum*.
 —*P. lûtécens*—*P. Spicerianum* × *P. javanicum*.—*P. lûteum*—*P.*
Fairieanum × *P. Spicerianum*. G.C. III. 49:402. —*P. Lynchidnum*
 —*P. Spicerianum* × *P. Selligerum*.—*P. Macfarlanei*—*P. callosum* ×
P. Spicerianum.—*P. macropterum*—*P. Lowii* × *P. superbiens*.—*P.*
Mâhleræ—*P. Lawrenceanum* × *P. Rothschildianum*.—*P. Mângoldii*.
 —*P. marmorophyllum*—*P. Hookeræ* × *P. barbatum*.—*P. Marshal-*
lidnum—*P. venustum* × *P. concolor*.—*P. Masereelidnum*—*P. Lee-*
anum.—*P. Massaidnum*—*P. supercilare* × *P. Rothschildianum*.—*P.*
Mâidæ—*P. Lawrenceanum* Hycanum × *P. callosum* Sanderæ.
 A.G. 25:211. G. 33:737. —*P. Mâidæ magnificum*—preceding. G.C.
 III. 30:129. —*P. Mâynardii*—*P. purpuratum* × *P. Spicerianum*.—*P.*
Measuresidnum—*P. villosum* × *P. venustum*. Gn.W. 4:73. —*P.*
Measuresidnum paroninum—*P. Boxallii* × *P. venustum*.—*P. Melan-*
thus—*P. Hookeræ* × *P. Stonei*.—*P. Memoria-Moensii*—*P. Harris-*
ianum × *P. Spicerianum*.—*P. microchilum*—*P. Druryi* × *P. niveum*.
 G.Z. 28, p. 267. —*P. Minos*—*P. Arthurianum* × *P. Spicerianum*.—*P.*
Mlle. Madeline Gayot—*P. Dayanum* × *P. insigne* Chantini. —*P.*
Mme. Barbey—*P. Lawrenceanum* × *P. tonsum*.—*Mme. Coppe*—*P.*
Harrisianum × *P. Spicerianum*.—*P. Mörzanæ*—*P. superbiens* × *P.*
Stonei. I.H. 34:5. G.C. III. 41:66. J.H. III. 50:49. —*P. Mör-*
zanæ—*P. Chamberlainianum* × *P. Leeanum*. G.M. 47:103. —*P. Mrs.*
Canham—*P. superbiens* × *P. villosum*.—*P. Mrs. G. D. Over*—*P.*
superbiare × *P. villosum*.—*P. Mutus*—*P. hirsutissimum* × *P.*
Lawrenceanum.—*P. Niobe* (Fig. 2761)—*P. Spicerianum* × *P.*
Fairieanum.—*P. nitens*—*P. villosum* × *P. insigne* Maulei. —*P.*
nitens Gravesianum.—*P. nitens Sallieri*—*P. insigne* × *P. villosum*.
 —*P. nitens Sallieri Hyednum*—*P. insigne* × *P. villosum*.—*P.*
nitens Schlesingerianum—*P. Boxallii* × *P. insigne*.—*P. nitens*
Mons de Cûrte—*P. Boxallii* × *P. insigne* Chantini. —*P. Numa*—*P.*
Lawrenceanum × *P. Stonei*.—*P. Oakes Ames*—*P. ciliolare* × *P.*
Rothschildianum.—*P. obscurum* × *P. barbatum* × *P. insigne*.—*P.*
andanthum—*P. Harrisianum* × *P. insigne*.—*P. andanthum superbum*—
P. Harrisianum × *P. insigne* Maulei. —*P. Olivia*—*P. tonsum* × *P.*
niveum.—*P. Orestes*—*P. Harrisianum* × *P. insigne*.—*P. Orion*—*P.*
concolor × *P. insigne*.—*P. Orphanum*—*P. barbatum* × *P. Druryi*.—*P.*
Oebornei—*P. Harrisianum* superbum × *P. Spicerianum*.—*P. Page-*
dnum—*P. superbiens* × *P. Hookeræ*.—*P. pallens*—*P. Spicerianum* ×
P. Dayanum.—*P. Patersonii*—*P. Lowii* × *P. Dayanum*.—*P. pa-*
soninum—*P. Boxallii* × *P. venustum*. A.F. 7:707. —*P. Pelias*—*P.*
Haynaldianum × *P. insigne*.—*P. pellucidum*—*P. Dayanum* × *P.*
insigne.—*P. Pelops*—*P. Niobe* × *P. Sementa*.—*P. picturatum*—*P.*
Spicerianum × *P. superbiens*.—*P. Pûcheridnum*—*P. Harrisianum*
 superbum × *P. Spicerianum*.—*P. Pûcheridnum Williamsii*—*P.*
Harrisianum × *P. Spicerianum*.—*P. Pleistochlorum*—*P. barbatum*
 × *P. virens*.—*P. Pleuronetron*—*P. venustum* × *P. villosum*.—*P.*
Plumerum—*P. Harrisianum* × *P. venustum*.—*P. polium*—*P. bar-*
batum × *P. venustum*.—*P. Pollettianum*—*P. callophyllum* × *P. cen-*
anthum superbum. —*P. polydigmaticum*—*P. Spicerianum* × *P. venus-*
tum. —*P. Premier*—*P. Cymatodes* × *P. Rothschildianum*.—*P. Pre-*
veliti—*P. Harrisianum* × *P. Lawrenceanum*. —*P. Priapus*—*P. phil-*
ippinense × *P. villosum*.—*P. Princessæ*—*P. Coffinetii* × *P. Fairies-*
num.—*P. punctatum*—*P. Boxallii* × *P. Leeanum*. Gt. 51:1503. —*P.*
radidum—*P. Lawrenceanum* × *P. Spicerianum*.—*P. Rapparti-*
dnum—*P. Charlesworthii* × *P. Lathamianum*. G.M. 46:723. —*P.*
regale—*P. insigne* Maulei × *P. purpuratum*.—*P. Reginaldianum*—
P. insigne × *P. siamense*.—*P. Robinsonianum*—*P. Lawrenceanum* ×
P. superbiens.—*P. Rôlfei*—*P. bellatum* × *P. Rothschildianum*.
 R.H. 1911:254. —*P. Rôlfei superbum*—preceding. G.C. III. 36:399.
 Gn.W. 21:1041. —*P. Rosetti*—*P. insigne* Sanderianum × *P. Mâ-*
idæ. —*P. Rothschildiâno-Boxallii*—*P. Rothschildianum* × *P. Boxal-*
lii. —*P. Rothschildiâno-Lawrenceanum*—*P. Rothschildianum* × *P.*
Lawrenceanum. —*P. Rothschildiâno-superbiens*—*P. Rothschildi-*
anum × *P. superbiens*. —*P. Rothschildiâno-tonsum*—*P. Rothschildi-*
anum × *P. tonsum*. —*P. Rouallidnum*—*P. villosum* × *P. venustum*. —
P. rubescens—*P. Boxallii* × *P. cenanthum*. —*P. Sallieri*—*P. insigne*
 × *P. villosum*. —*P. Sallieri aureum*.—*P. Sallieri Hyednum*—*P.*
insigne × *P. villosum*. —*P. Sallieri nigro-maculatum*.—*P. Sallieri pic-*
tum. —*P. Sallieri platyptalum*. —*P. Sanactrus etonienæ*—*P. Acteus*
langleyense × *P. insigne* Harefield Hall. —*P. Sanderiâno-Curtisii*.
 G.C. III. 27:75. —*P. Sanderiâno-superbiens*. J.H. III. 54:251. —*P.*
Sappho—*P. barbatum* × *P. Lowii*. —*P. Savagednum*—*P. Harris-*
ianum × *P. Spicerianum*. —*P. Schlesingerianum*—*P. Boxallii* × *P. in-*
signe. —*P. Schroeders*—*P. Fairieanum* × *P. cenanthum*. Gn.W. 7:
 201. —*P. Selligerum*—*P. barbatum* × *P. philippinense*. G.Z. 22, p.
 193. —*P. Selligerum majus*—preceding. Gng. 11:1349. 18:370. A.F.
 35:108. —*P. Selligerum porphyreum*—same. —*P. Seegerianum*—*P.*
Harrisianum × *P. Spicerianum*. —*P. Shillidnum*—*P. Gowerianum*
 × *P. Rothschildianum*. Gn.W. 16:57. —*P. siamense*—*P. Apple-*
tonianum × *P. callosum*. —*P. sibyrolense*—*P. Boxallii* × *P. insigne*.
 —*P. Siebertianum*—*P. Dayanum* × *P. insigne*. —*P. Spicero-*
nium—*P. Spicerianum* × *P. niveum*. —*P. supercilare*—*P. bar-*
batum × *P. superbiens*. —*P. Susan Ames*—*P. Leeanum* × *P. nitens*.
 —*P. Stend Brun*—*P. Curtisii* × *P. Lowii*. —*P. Swanidnum*—*P. bar-*
batum × *P. Dayanum*. —*P. Swinburnei*—*P. Argus* × *P. insigne*
 Maulei. —*P. Swinburnei magnificum*—preceding. —*P. Tautzianum*
nigricans—*P. barbatum* × *P. niveum*. Gn. 71, p. 89. J.H. III.
 54:179. —*P. T. B. Haywood*—*P. Druryi* × *P. superbiens*. —*P.*
tessellatum—*P. barbatum* × *P. concolor*. A.F. 7:707. —*P. tessel-*
latum porphyreum—preceding. —*P. tessellatum rubens*—*P. barbatum*
 × *P. concolor*. G.C. III. 39:19. —*P. Thalia Mrs. Francis Wellesley*
 —*P. insigne* × *P. Schroeders*. —*P. Thayerianum*—*P. Boxallii* × *P.*
Lawrenceanum. —*P. Thetis*—*P. barbatum* × *P. venustum*. —*P.*
Thibautidnum—*P. Harrisianum* × *P. insigne* Maulei. —*P. Thomp-*
sonii—*P. Spicerianum* × *P. villosum*. —*P. Thorntonii*—*P. insigne*
 × *P. superbiens*. —*P. Thorntonii Blombergii*—preceding. —*P. Tityus*
 —*P. cenanthum* × *P. Spicerianum*. —*P. tonso-Arthurianum*—*P. ton-*
sum × *P. Arthurianum*. —*P. tonso-Charlesworthii*—*P. tonsum* × *P.*

Charlesworthii.—*P. tonso-purpuratum*—*P. tonsum* × *P. purpura-*
tum.—*P. tonso-Sanderæ*—*P. tonsum* × *P. insigne* Sanderæ. —*P.*
tonso-villosum—*P. tonsum* × *P. villosum*. —*P. Tracydnum*—*P. au-*
reum × *P. Leeanum*. G.M. 52:260. Gn.W. 22:159. —*P. Transvaal*
 —*P. Chamberlainianum* × *P. Rothschildianum*. —*P. trimphans*—
P. nitens × *P. cenanthum*. G.M. 48:742. —*P. triumphans magnif-*
cum—preceding. G.M. 47:794. —*P. Troilus*—*P. insigne* × *P. nitens*.
 —*P. Turpe*—*P. barbatum* × *P. Argus*. —*P. T. W. Bond*—*P. hirsu-*
tissimum × *P. Swanianum*. —*P. Umlaufidnum*—*P. insigne* × *P.*
Lawrenceanum. —*P. Van Houttednum*—*P. barbatum* × *P. villosum*.
 —*P. Vernitrium*—*P. Argus* × *P. villosum*. —*P. Verillidnum*—*P.*
barbatum × *P. Fairieanum*. —*P. Wallertidnum*—*P. Harris-*
ianum × *P. villosum*. —*P. westfieldense*—*P. Leeanum* × *P. Pollettia-*
num. Gn.W. 22:69. —*P. Wiganidnum*—*P. Ashburtonæ* × *P. Harris-*
ianum. —*P. William McKinley*. —*P. Williamsidnum*—*P. Harris-*
ianum × *P. venustum*. —*P. Winnidnum*—*P. Druryi* × *P. villosum*. —
P. W. R. Lee—*P. Rothschildianum* × *P. superbiens*. —*P. W. W.*
Lunt—*P. Boxallii* × *P. insigne*. —*P. Youngidnum*—*P. philippinense*
 × *P. superbiens*. —*P. Youngidnum superbum*—preceding. G. 28:
 67. G.C. III. 40:439. —*P. Zampa*—*P. hirsutissimum* × *P. Leeanum*
 —Other names may be expected in the trade.

GEORGE V. NASH.

PAPYRUS (an ancient name, coming through the Greek, and from which comes indirectly the word *paper*). *Cyperaceæ*. A group of aquatic or subaquatic very ornamental plants, now considered to represent one polymorphous species; by modern authors they are placed in the genus *Cyperus* (which see, page 941, Volume II).

The paper-reed, *Cyperus Papyrus*, Linn. (*Papyrus antiquorum*, Link. *P. sticula*, Parl. *Cyperus syriacus*, Parl.),



2762. *Papyrus antiquorum*.

Fig. 2762, is of the Nile region and widespread in Trop. Afr., also of Sicily. It is a glaucous perennial with a woody rhizome, reaching 10-15 ft. in height in favorable regions, the tall sts. solitary or very few from each root and varying from nearly terete to acutely 3-angled; lvs. all radical (only sheaths produced on the flowering culm), long and sedge-like: umbel compound on the top of the high culm, the primary rays many and 6-20 in. long, drooping; spikelets 1 × 1½ in., with

many spreading spikelets; wings of rachilla lanceolate, yellow, falling early with the glumes; stamens 3, the anthers joined by a crested connective: nut or fr. ellipsoid, 3-cornered, gray. Var. *antiquorum*, Clarke (*P. antiquorum*, Willd. *P. mossambicensis*, Parl. *Cyperus Papyrus*, Linn., in part), has spikelets more or less deciduous above the 2 lowest or empty glumes, the wings of the rachilla obtuse and tardily falling, the connective not crested. This variety occurs in Trop. and N. Afr. and in Palestine.

The papyrus is popular about large tanks or aquaria in greenhouses, and is often bedded out about ponds in summer. Far South it may stand in the open. It is much used in California for adornment of lawns, doing well even with a moderate supply of water. The fluffy heads make attractive house decoration. The papyri of the ancient Egyptians were made of strips taken from the culm or stem, from base to apex, between the cortex and the core, being laid side by side and beaten and pressed together to form a continuous surface.

The paper-reed is known best to horticulture as a tender decorative plant, almost solely as an aquatic. It stands by itself, unequaled and unrivaled as such. It has tall dark green stems 10 or more feet high, depending on mode of culture, surmounted with an umbel of threadlike leaves or filaments, subdivided, and forming a most graceful and ornamental object. It is at home on the margin of a natural pond, or it may be planted in a tub or box of rich soil and placed in the artificial pond, but should be only slightly submerged. The plant should not be subjected to a spray from a fountain jet, as the weight of water will bend and break the stems. They may also be planted in groups similar to cannas, but should receive copious supplies of water, otherwise they will be dwarf and stunted. Propagation is effected by seed. Sow and treat seedlings similar to *Cyperus alternifolius*, the common umbrella plant. Sow in early autumn or spring; seedlings will make good plants the same season. Winter the medium-sized plants in a cool greenhouse with all light and air possible, else the plants become drawn and weak and crippled with aphids. Large plants may be divided in spring. (William Tricker.)

L. H. B.

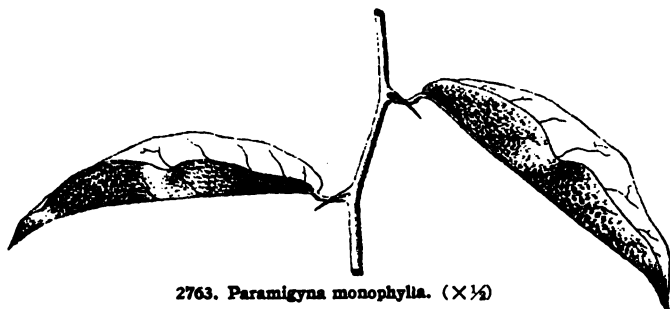
PARACHUTE FLOWER: *Ceropegia Sandersonii*.

PARADISEA (said to be from Paradise, of which this plant is supposed to be a fit inhabitant). Often written *Paradisica*. *Liliaceae*. ST. BRUNO'S LILY. Hardy herbaceous perennial, a single species, with small white flowers, native in the Pyrenees, Apennines, Alps, and Juras.

St. Bruno's lily and St. Bernard's lily are advertised in catalogues of hardy herbaceous plants as *Anthericum Liliastrium* and *Anthericum Liliago*, but the former should be called *Paradisea Liliastrium*; the latter is St. Bernard's lily. Both have white fls., borne in early summer on scapes a foot or more high. The fls. of both are tipped green outside. The lvs. are linear, all radical, and a foot or so long. Both plants are natives of Cent. Eu., and by their popular names recall the life-saving monks of the Alps. It is no wonder, then, that they are often confused, although they belong to different subtribes. The *Paradisea* has larger fls., which are funnel-shaped rather than rotate, but the fundamental differences upon which *Paradisea* is made a separate genus lie in the stamens. In *Paradisea* (according to Bentham & Hooker) the anthers are attached at the middle of the back and are versatile; in *Anthericum* the anthers are attached at their base and are erect; moreover, the stamens of *Paradisea* are hypogynous; of *Anthericum*, perigynous. Following are some

of the other differences as given by Baker in Journ. Linn. Soc. 15:286, 287, 301 (1877):

Liliastrium, Bertol. (*Anthericum Liliastrium*, Linn. *Czackia Liliastrium*, Andr.), has 6-8 lvs.: scape 12-24 in. high; raceme 2-10-fl.; bracts lanceolate; perianth 18-21 lines long; style 15-18 lines long; ovary and caps.



2763. *Paramigyna monophylla*. (X 1/2)

oblong.—*Anthericum Liliago*, Linn., has 12-20 lvs.: scape 6-15 in. high; raceme (sometimes panicle) 10-20-fl.; bracts linear; perianth 6-9 lines long; style 5-6 lines long; ovary and caps. globose. Some of the above characters may not hold for cult. plants.

Var. *major*, Hort., is much larger and a better form than the type, growing 2-3 ft. high and bearing more and larger fls. Gn. 9:12 (as *Anthericum Liliastrium* var.) has fls. 2 in. long and 2 1/2 in. across. Var. *gigantum*, Hort., is probably the same. *P. Liliastrium* and its varieties are plants of secondary importance in the hardy border; they are of simple cult.; prop. by division, or by seeds sown as soon as ripe.

WILHELM MILLER.
L. H. B.†

PARADISE FLOWER: *Strelitzia Reginae*.

PARAMIGYNA (from the Greek *to mix with*). *Rutaceae*, tribe *Citreae*. Evergreen climbing shrubs native to India and distantly related to the orange, but having fruits filled with gum.

Leaves alternate, unifoliate, articulated with the long petiole; spines recurved: fls. solitary or in clusters in the axils of the lvs., large, white, 4-5-merous with 8-10 free stamens; ovary 3-5-celled with 1-2 ovules in each cell: fr. globose or elliptical, gummy, with a lemon-like peel.—Several species are known. The following is being tested as a stock by the U. S. Dept. of Agric.

monophylla, Wight. Fig. 2763. An evergreen climbing shrub related to *Citrus*: lvs. simple, alternate; spines recurved: fls. large, white, 4-5-merous, with free stamens: the young lvs. are pendent, the twigs, spines, petioles and leaves are all more or less hairy. Talbot, For. Fl. Bombay, p. 200, fig. 122. Wight, Ill. Ind. Bot., pl. 42.

Several other species occur in the Indo-Malayan region; two have recently been described from the Philippines: *P. longipedunculata*, Merrill, a scandent shrub, closely related to *P. monophylla*, from which it differs in its longer peduncles and several other characters; *P. mindanensis*, Merrill, a nearly glabrous scandent shrub, with shining lvs. and glabrous fr., usually curved.

WALTER T. SWINGLE.

PARA-NUT: *Bertholletia*.

PARASITE. A parasitic plant or animal is one which fastens itself upon another living thing, penetrating the tissues of the host or organism attacked, thus usually deriving some or all of its nutriment therefrom. Parasitic plants are numerous, but the larger part of them are to be found among the fungi and the bacteria. These two classes of organisms are the chief causes of plant diseases,—such as rusts, smuts, mildews, and blights. It is with such parasites as these that plant pathology is primarily concerned, and path-

ologists estimate that in the United States alone the annual losses to crops from parasitic fungi and bacteria amount to not less than \$600,000,000. Parasitic fungi commonly grow within the tissues of the host plant, reaching the surface only when forming certain types of spores, or propagative bodies. Parasites invariably cause some disturbance of the normal development of the tissues. Notwithstanding this fact, it can be said that there are beneficial parasites, such as the bacteria producing the nodules, or tubercles, on the roots of legumes; and these nodules are important because of the fixation therein of atmospheric nitrogen, which ultimately becomes a source of nitrogen supply for the legume host.

There are also parasites among flowering plants. Of these, two principal classes may be noted: (1) those green in color, or chlorophyll-containing, such as the mistletoe and the bastard toad-flax; and (2) those practically devoid of chlorophyll, such as the dodder and the broom-rape. The members of the first class are commonly supposed to be active photosynthetically, that is, they are able to manufacture their own carbonaceous food-supply from carbon dioxide and water, while members of the second class must receive all or nearly all similar foods through the host plant. Plants living upon dead organic substance are termed saprophytes (which see). There are all gradations between parasites and saprophytes, especially among the fungi. Some are parasitic during their more active vegetative growth, and then continue their development saprophytically. Again, there are many fungi which, while generally parasitic, may be grown in the laboratory upon a variety of culture media, or cooked plant products. Finally, there are those which ordinarily live saprophytically in the soil, but under certain conditions are able to induce disease epidemics.

B. M. DUGGAR.

PARATRŌPIA (Greek, *turned away*, probably with reference to the twining habit). *Araliaceæ*. Twining trees or shrubs similar to *Aralia*, with compound lvs.: infl. paniculate or racemose. The genus is now included in *Schefflera* by most authorities. *P. Steltzneriana*, Barb.-Rodr. The plant intro. into Calif. under this name grows up to 24 ft. high, evergreen: lf. palmately 6-foliate; lfts. leathery, oblong, short deltoid acuminate, petioles articulate at the petiole.

PARDANTHUS: *Belamcanda*.

PARIETARIA (from *parietarius*, belonging to walls, referring to its habitat). *Urticaceæ*. Annual or perennial herbs widely scattered in the temperate zones, scarce in the tropics. Fls. polygamous, cymose or glomerate at the axils; perianth of the hermaphrodite and male fls. deeply 4-lobed, rarely 3-lobed; lobes valvate; of the female fl. distinctly tubulous at the base, lobes shorter; stamens 4, rarely 3; ovary free within the perianth; stigma penicillate, short or linear: achene included in the persistent perianth. Ten or more species. *P. arborea*, Ait., an erect shrub, with lvs. perfectly white underneath, has been offered in trade-lists. This belongs in the genus *Gesnouinia*, differing from *Parietaria* in being small trees with the involucre subtending 3-fld. glomerate-panicled branches: fls. monœcious, the central pistillate, with the achene included in the tube of the involucre. *Gesnouinia* contains 2 species belonging to the Canary Isls.

PÂRIS (the berry of the plant is compared to the apple of discord, while the four leaves surrounding it are likened to Paris and the three envious goddesses, Juno, Minerva, and Venus. Others think the name is derived from *par*, equal, referring to the agreement in number between leaves and floral parts, and this is probably the correct derivation). *Liliaceæ*. **HERB-PARIS**. **LOVE-APPLE**. Hardy small herbs.

PARKINSONIA

Differs from *Trillium* in having its floral parts in 4's instead of 3's. There are about 6 species altogether, and in some of them the floral parts are in higher numbers than four. They resemble trilliums in being small hardy rhizomatous plants, found in mountainous countries of the North Temperate Zone, and even in the arctic regions; also they have a single whorl of lvs. at the top of the scape and a single fl., but in *Paris* the outer perianth-segms. are more herbaceous and calyx-like, while the inner ones are much narrower and less showy, being mere strips of petal, or even entirely absent.

quadrifolia, Linn. **HERB-PARIS**. **TRUE-LOVE**. **FOUR-LEAVED GRASS**. Height 9-12 in.: lvs. all cauline, netted-veined (exceptional among monocotyledons): peduncle rising 1-2 in. above lvs.: perianth-segms. yellowish green, the 4 inner ones rather more yellow: berry bluish black. The dominant European type, scattered over Eu. and Siberia from the Arctic Circle to the Medit., in woods and shady places, but usually local. Gn. 31, p. 165.—Fls. in spring or early summer. Rarely the lvs. and floral parts are in 5's.

WILHELM MILLER.

PARITUM: *Hibiscus elatus* and *H. tiliaceus*.

PARK: *Landscape Gardening*, page 1801.

PÂRKIA (named after Mungo Park, born in 1771). *Leguminosæ*. Tall unarmed trees: lvs. evenly bipinnate; lfts. very numerous, small: fls. in dense, long-peduncled, obovoid heads; calyx tubular, shortly 5-cleft; corolla tubular, somewhat cleft; stamens 10; ovary stalked: pod large, flat, strap-shaped, coriaceous.—About 10 species, tropics of both hemispheres. *P. timoriæna*, Merr. **CUPANG**. A very large tree, up to 115 ft. high, with vase-shaped, wide-spreading crown: lvs. fernlike, with very small lfts.: fls. small, white and yellow, in dense pear-shaped panicles: pods pendulous, flattened, black, 18 in. long. Timor and Philippines. Intro. in U. S. by Dept. of Agric. and offered for distribution.

PARKINSONIA (John Parkinson, 1567-1629, London apothecary, author of the delightful "*Paradisus Terrestris*" and "*Theatrum Botanicum*"). *Leguminosæ*. Tropical trees or shrubs, with a thin smooth bark and armed with simple or three-forked spines.

Leaves alternate or fascicled, bipinnate, with 1-4 pairs of pinnae; the common petiole short, often obsolete or spinescent; stipules minute or none: fls. yellow or whitish, on slender pedicels in short, loose axillary or terminal racemes; calyx 5-parted, produced at base and jointed upon the pedicel; petals 5, clawed, the upper one within and broader than the rest, somewhat cordate, the claw pubescent and nectariferous on the inner side; stamens 10, free, the upper one gibbous outside; ovary several-ovuled, shortly stipitate: pod compressed, leathery, 2-valved, linear to linear-oblong, more or less twisted, tapering at both ends; seeds compressed, albuminous, with a crusty brown testa.—Five species. The dominant type, both in the wild and in cult., is *P. aculeata*, the Jerusalem thorn, which is probably a native of Amer., but is naturalized or cult. in all tropical countries. One species is S. African, one is S. American, and the remainder belong to the region between Texas and S. Calif. *P. aculeata* is a thorny evergreen tree with feathery drooping branches and handsome yellow fls.; it is admirable for hedges, thrives in the driest places and can endure some cold. It has been cult. in European conservatories, being usually raised from imported seeds, but it is of difficult cult. *P. Torrejana*, though generally destitute of lvs., is known in N. Mex. as "palo verde," from the bright green color of the branches. It stands drought even better than *P. aculeata*. These plants belong to the same tribe with such fine northern trees as *Gleditsia*

and *Gymnocladus* and such southern kinds as *Cæsalpinia*, *Poinciana*, and *Colvillea*. They are little known horticulturally.

A. Lfts. numerous; rachis flat, long.

aculeata, Linn. JERUSALEM THORN. Small glabrous tree, up to 10 ft. tall, the slender zigzag branches often pendulous: lvs. 8–16 in. long, with spiny petioles $\frac{1}{2}$ –1 in. long; lfts. numerous, very small, distant, linear to linear-oblongate, $\frac{1}{2}$ –4 in. long, inequilateral, on slender petioles; rachis winged, $\frac{1}{2}$ –1 $\frac{1}{2}$ ft. long; racemes slender, axillary, 3–6 in. long; fls. fragrant, pendulous; calyx glabrous, tube very short, lobes oblong, reflexed, exceeding the tube; petals yellow, $\frac{3}{8}$ – $\frac{5}{8}$ in. long, blades suborbicular or oval, longer than the claws; stamens and ovary pubescent: pods narrow, 2–4 in. long, constricted between the seeds; seeds oblong. Probably Trop. Amer. S.S. 3:131.

AA. Lfts. few; rachis terete.

Torreyana, Wats. Small tree, 18–25 ft. tall, with light green, smooth bark: young branches and lvs. sparingly pubescent: lfts. 2 or 3 pairs, oblong, obtuse, narrowed toward the scarcely oblique base, glaucous, about $\frac{1}{4}$ in. long; racemes terminal with rather long pedicels, jointed near the middle, but joint not evident until in fr.; petals bright yellow, a prominent gland on the upper one: pod acute, more or less constricted between the very thick ventral suture. Valley of the Colo. and eastward through W. Texas.—Usually naked in the S.W. as the lvs. are early deciduous.

P. L. RICKER.

PARMENTIERA (named after Ant. Aug. Parmentier, who intro. potato-cult. into France). *Bignoniaceæ*. Shrubs or small trees with spirally placed fls. in 3's: fls. from the old wood on rather long peduncles, almost regular; calyx spathe-like, splitting up one side; corolla campanulate-funnelform, little crooked, limb sub-2-labiate, posterior 2-parted, anterior 3-parted, lobes all broadly spreading; stamens 4, scarcely exerted; ovary sessile, 2-loculate, many-seeded: fr. elongate-cylindrical or oblong: lvs. alternate or subopposite, 3-foliate or some simple, common petiole often broad. Species 2, from Mex. and Panama. *P. cerifera*, Seem., from Panama, called "palo de vela," or candle-tree, from its long cylindrical frs. which are smooth and white like candles, has been offered in the trade.

PARNASSIA (after Mt. Parnassus). *Saxifragaceæ*. GRASS OF PARNASSUS. Low-growing moisture-loving hardy perennial herbs of tufted habit, sometimes transferred to gardens.

Glabrous, from short rootstocks, mostly with scape-like sts.: lvs. simple and entire, mostly radical (or basal) and petiolate, 1 on the st. sessile and mostly small: fls. usually 1, white or yellow; calyx 5-parted; petals 5, withering, but deciduous; fertile stamens 5, alternating with the petals; staminodia present or represented by glands; ovary 1-celled; style very short or none; stigmas usually 4; ovules many: caps. 1-celled, with 4 placentæ projecting within, 4-valved (sometimes 3-valved).—In wet or moist places in temperate and subarctic regions in the northern hemisphere, about 25 species. They are suitable for shady positions along the water's edge, and are prop. by seeds or division. They commonly grow about 6 in. high, but attain 2 ft. They bloom from June to Sept.; the petals are conspicuously veined with green lines. The plant which Dioscorides called "grass of Parnassus" is *P. palustris*, the only species common in Eu. This is perhaps the best one for cult., but they are all much alike in horticultural value. Parnassias prefer a peaty soil, but such is not necessary. The species are usually tenacious of life and are good perennials. The N. Carolinian species are hardy N.

A. Petals not clawed.

B. Rudimentary stamens 9–20 at the base of each petal.

C. Scape-lf. more or less clasping.

palustris, Linn. GRASS OF PARNASSUS. Rootstock short and erect: lvs. ovate, usually cordate at the base; scape-lf. ovate or cordate, at or below the middle of st.: fls. $\frac{1}{2}$ –1 in. across; rudimentary stamens 9–15 scales at the base of each petal. Eu., Asia, N. Amer., south to Mich. and Wyo. Gn. 41, p. 500; 78, p. 450. G.L. 26:365. A.G. 13:696.

cc. Scape-lf. not clasping.

californica, Greene (*P. palustris* var. *californica*, Gray). Height 1–2 ft.: lvs. ovate or ovate-oblong, cuneate at base, 1–2 in. long; scape-lf. very small, and borne above the middle: fls. $1\frac{1}{2}$ in. across; rudimentary stamens about 20 at the base of each petal. Calif.

BB. Rudimentary stamens 3–5 at the base of each petal.

caroliniana, Michx. Rootstock erect, very short: height 8–16 in.: lvs. ovate, broadly oval or orbicular, more or less cordate at the base; scape-lf. borne below the middle: fls. $\frac{3}{4}$ – $1\frac{1}{2}$ in. across; rudimentary stamens usually 3 in each set. Swamps and low meadows, New Bruns. to Man., south to Va. B.M. 1459.

AA. Petals clawed.

B. Rudimentary stamens usually 3 at the base of each petal.

asarifolia, Vent. Rootstock erect, short and thick: height 10–16 in.: lvs. orbicular, kidney-shaped at the base, often 2–3 in. wide; scape-lf. clasping, borne at about the middle: petals entire. Wet places in high mountains of Va. and N. C. B.B. 2:184.

BB. Rudimentary stamens 5–9 at the base of each petal.

fimbriata, König. Rootstock ascending, short: height 1 ft. or less: lvs. kidney-shaped to cordate-ovate; scape-lf. cordate, more or less clasping, at or above the middle: petals fringed below the middle. Colo. to Calif. and north in Alberta and to Alaska.

P. nubicola, Wall. The largest and coarsest of all the species, and lacks the delicate beauty and white petals of *P. palustris*: lvs. elliptic-ovate; scape-lf. borne below the middle: petals shorter than in the other kinds as compared with calyx-lobes; rudimentary filaments 3, not topped by anthers. Himalayas. B.M. 6609.

WILHELM MILLER.

L. H. B.†

PAROCHÆTUS (Greek, *beside*, and *ditch* or *canal*). *Leguminosæ*. A half-hardy perennial trailer, with foliage like the shamrock, but with each of the 3 lfts. marked at the base with a handsome brown crescent; the pea-shaped fls. have a cobalt-blue standard and pink wings. It is desirable for hanging-baskets, pots and rockeries, and is said to bloom the year round. *Parochætus* is a genus of one species. It is allied to the clovers, sweet clover, medick, and rest-harrow, and differs from them in having a more acute keel, a 2-valved pod, and the lfts. not stalked. It is a native of Trop. Asia and E. Afr., ascending the Himalayas from 4,000–13,000 ft. If seeds could be secured from the greatest altitude the plants might be hardy in the N. This plant was formerly offered by A. Blanc, of Philadelphia, under the name of shamrock-pea, or blue oxalis. It has recently been distributed by the U. S. Dept. of Agric. in an effort to give this attractive plant a place in American horticulture.

communis, Hamilt. SHAMROCK-PEA. BLUE OXALIS. Height 2–3 in.: rhizome thread-like, wide-creeping: petiole 2 in. long; lfts. obovate, emarginate, glabrous or slightly pubescent: peduncles 1–2-fld.; fls. $\frac{1}{2}$ – $\frac{3}{4}$ in. across, axillary: pod straight, glabrous, linear, $\frac{3}{4}$ –1 in. long. F.S. 15:1575.

P. L. RICKER.†

PARONYCHIA (old Greek name used by Dioscorides, meaning whitlow-wort, or a cure for whitlow, a disease of the fingers or toes). *Caryophyllaceæ*; by some sep-

arated in *Illecebrææ*. WHITFLOW-WORT. Annual and perennial little herbs, without showy flowers, adaptable to rock-gardens and borders.

Plant tufted, low, with minute clustered fls. and silvery stipules; erect or diffuse, often dichotomously branching: lvs. opposite, broad or narrow, entire, the margins flat or very rarely recurved; stipules prominent, scarious, shining: fls. minute, without petals, axillary or rarely in terminal cymes, usually hidden among the stipules; sepals 5, awned; stamens 5; staminodia 5 (sometimes wanting), bristle-like or reduced to teeth; style 2-cleft: fr. an urticule inclosed in the calyx.—Species about 50, largely in the Medit. region, but widely distributed; several are native in the U. S. A very few are cult. in the hardy border. The two European species here given do not appear in the leading catalogues, domestic or foreign, but *P. serpyllifolia* is said to be much used for carpet-bedding abroad. *P. argentea* furnishes the Algerian tea. Allied to *Herniaria*, which see for generic differences. The species described below are perennials. They are of simple cult.; prop. by seed and division.

A. Lvs. narrow, linear or awl-shaped.

argyrócoma, Nutt. (*Anychia argyrócoma*, Michx.). Erect or ascending perennial, 3-8 in. high, making broad tufts or mats, clothed with silvery appressed scale-like hairs: lvs. linear; stipules silvery white, scarious, entire, usually shorter than the lvs.: fls. in forking cymes; bracts large, silvery, membranous; staminodia minute. Rocky places. Maine and N. H. to Ga. and Tenn.—Also called silver chickweed, silverhead, and silver whitlow-wort. The northern form is sometimes separated as var. *albimontana*, Fern., differing from the type (which occurs from Va. south) in having branches mostly floriferous rather than most of them sterile, lvs. glabrate and with involute margins, and calyx-awns subulate and glabrescent.—*P. argyrócoma* is not difficult of cult. and is prized for rockeries, its silvery tufted appearance lending a distinct charm to the collection for this purpose. Prop. by seeds and division.

dichótoma, Nutt. Woody at the base, glabrous or nearly so, tufted, 4-14 in. tall: stipules entire, often 5-6 lines long, tapering into a slender awn: fls. in forking cymes; awns of the calyx-segms. divergent; staminodia of minute bristles. Dry soil, Md. and N. C. to Ark. and Texas.

AA. Lvs. rather broad, obovate or nearly so.

argénteá, Lam. Prostrate diffuse perennial, with long branches: lvs. ovate to oblong or lanceolate, acute: fls. lateral and terminal, dense, intermixed with lvs.; bracts ovate, acute, much longer than the fl.; calyx-lobes semi-scarious, hooded, mucronate on the back near the apex. Common in dry places, Medit. region.—Foliage nearly glabrous.

serpyllifolia, DC. Prostrate creeping perennial: lvs. obovate, flat, rather fleshy: fls. terminal; calyx-lobes blunt. Arid parts of S. and E. Eu.—Foliage ciliate at the margin. A disputed plant. Probably a form of *P. capitata*, Lam.

WILHELM MILLER.
L. H. B.†

PAROSÉLA. By some used instead of *Dalea*, p. 960.

PARRÓTIA (after F. W. Parrot, a German naturalist and traveler, afterward professor of medicine at Dorpat; 1792-1841). *Hamamelidææ*. Ornamental woody plants grown chiefly for their handsome foliage and also for their early appearing flowers.

Deciduous shrubs or small trees: lvs. alternate, short-petioled, crenate, with large caducous stipules: fls. small, in dense heads surrounded by an involucre of several bracts; petals wanting; calyx 5-7-lobed, embracing the pubescent ovary about half; stamens 5-15; styles 2: caps. 2-celled, with 2 beaks, dehiscent between

the beaks, with 1 oblong shining seed in each cell.—Two species in Persia and the Himalayas.

The parrotias are spreading shrubs or small trees with medium-sized orbicular to obovate-oblong leaves, small flowers in dense heads appearing before the leaves, and with fruit similar to those of the witch-hazel. The Persian species is hardy as far north as Massachusetts. Its chief beauty consists in the brilliant autumnal tints of the foliage, which changes to golden yellow, orange, and scarlet and remains a long time on the branches. The early appearing flowers with the purple pendulous stamens, are also attractive. The Himalayan species is more tender and its foliage turns only to pale yellow, but the flowers are somewhat more showy from their rather large white bracts. The parrotias grow in any well-drained soil and like a sheltered position. The wood is very close-grained, hard and strong, and therefore *P. persica* bears the name, "ironwood." The tough pliable branches of the Himalayan species are extensively used for basket-work and are also twisted into thick ropes used for the construction of twig-bridges over the great rivers of its native country. Propagation is by seeds and layers and also by greenwood cuttings under glass.

pérsica, C. A. Mey. Shrub or small tree, to 15 ft., with spreading branches: lvs. oval to obovate-oblong, obtuse, coarsely and crenately dentate above the middle, dark green above, pubescent beneath when young, 3-4 in. long: bracts of fl.-heads covered with dark brown tomentum; stamens 5-7, pendulous, with linear-oblong, purple anthers: fr. with recurved beaks. N. Persia. B.M. 5744.

Jacquemontiána, Decne (*Fothergilla involuérata*, Falc. *Parrotiopsis involuérata*, Schneid.). Spreading shrub or small tree, to 20 ft.: lvs. orbicular, crenately toothed, stellate-pubescent on both sides, 2-4 in. long: heads many-fl., with spreading white bracts sprinkled with a purplish scurf on the back; stamens about 15, erect, with yellow, oval-oblong anthers. Himalayas. B.M. 7501.

ALFRED REHDER.

PARROT'S BILL: *Chianthus*.

PARROT'S FEATHER: *Myriophyllum*.

PÁRRYA (Capt. W. E. Parry, Arctic explorer). *Cruciferae*. Four or 5 N. American and a few Asiatic low perennial herbs, with thick caudices, scape-like peduncles, narrow lvs. and mostly racemose rose-colored or purplish showy fls.; sepals oblong and erect, the lateral ones gibbous at base; petals broad, clawed: pod broad and flat, mostly elliptic, with orbicular seeds. The parryas are alpine or boreal often arctic plants, and some of them will no doubt prove useful for the alpine garden. So far they are practically unknown in

American gardens. The most likely species to be used in rock-gardening is *P. Menziesii*, Greene (*Cheiranthus Menziesii*, Benth. & Hook.). It has a leafy scape 3-8 in. high, with a raceme of many



2764. Curl-leaved parsley.

fls., the petals nearly $\frac{1}{2}$ in. long and bright purple: lvs. spatulate or oblanceolate, entire, densely tomentose. N. Calif., north to the Lower Columbia River. L. H. B.

PARSLEY (*Petroselinum hortense*, which see). Fig. 2764. A leaf vegetable, used for garnishing and flavoring.

While indispensable in the market-garden, parsley is not usually found in the home-gardens in this country.

The addition of a bit of parsley foliage, finely chopped, heightens the flavor of soups, fish, and the like. The principal use of this vegetable, however, is for garnishing meats and fish and other dishes, and for this purpose it seems to be the vegetable *par excellence*, equally desirable in the home as on the hotel table.

A very few plants of parsley will suffice for the home-garden, and any spot of good soil will do for starting them from seed. Sow as early in spring as practicable, either in an early hotbed or coldframe, or in open ground. Parsley seed germinates somewhat slowly, and the plants are feeble at first. In open ground, early sowing aids the plants to get ahead of the weeds. In larger patches the rows should be a foot apart, and seed sown rather thinly in shallow drills. Thin the plants to stand 4 to 8 inches apart, and cultivate same as carrots. Gather the leaves as needed. For use in winter and early spring, start plants in open ground in early fall, and on the approach of cold weather set them in a corner of the greenhouse bench, or in a box or keg filled with rich loam placed in a light kitchen or cellar window. Old roots, if still vigorous, may be lifted in autumn and treated the same as seedlings. Parsley will stand considerable frost. Although biennial or perennial, a new stock should be started every year. The plants usually bear better if the leaves are removed a few at a time rather than to have the entire crown cut at once.

When the plant is a year old (sooner or later), it throws up seed-stalks, and produces seed in abundance, even under glass protection. By keeping the seed-stalks closely cut out, the season of leaf-yield may be prolonged for a time. Seed is easily gathered and cleaned.

The varietal differences lie chiefly in the foliage, which in some sorts is rather coarse, as in the Plain or Common, or more finely divided, as in the Curled, Double Curled, Moss Curled, and Fern-leaved.

T. GREINER.

L. H. B.†

PARSNIP (*Pastinaca sativa*, which see). Fig. 2765. A favorite vegetable, cultivated for its edible root, which is used mostly in winter and spring.

The average home-gardener thinks much of quick results. The drawback to parsnip-growing, in his estimation, is the length of time the crop requires for its development. When seed is sown, in early spring, the harvest seems a long way off. To offset this disadvantage, however, parsnips become available as green material when other things fresh from the garden are very scarce or entirely absent, that is, in open spells in winter, and in the very early days of spring. A crop of good straight roots may not be so easily produced as a crop of smooth carrots, but when once grown it does not burden one with much responsibility in regard to storage or keeping, which is an important point in its favor. The roots may be left in the ground where they grew or stored in moss or sand in the cellar. The winter freezing in the ground does not injure them; in fact, some growers suppose that it improves the quality. This ability to withstand the winter makes them valuable also as food for cattle, sheep, hogs and poultry in the early spring, in case the table or market should not call for them at that time. If dug in autumn, they may be stored in a cool, moist cellar (or buried) as other roots are kept.

The best soil for parsnips is a clean rich loam, which offers no obstruction to the uniform expansion of the roots. Straight deep roots must have a deep soil. Prepare it the same as for beets or carrots, or for any other garden crop. The seed should be strictly fresh, as it soon loses its vitality. Seeds germinate rather slowly and therefore the ground should be clear of roots and seeds of weeds, otherwise the young plants may be smothered. Sow in early spring, preferably with a garden seed-drill, $\frac{1}{2}$ to 1 inch deep, in rows 15 to 20 inches apart in the garden, and somewhat farther in field culture, in the place where the plants are to stand.

Be prompt in thinning the young seedlings to 6 to 12 inches apart in the row; at the same time pull up or cut out all weeds. The free use of the hand wheel-hoe will keep the patch clean until the entire surface of the ground is covered with foliage, thus preventing further growth of weeds. Tillage may then cease.

Seed is easily grown. Plant the roots in spring in any good soil, and gather the seed-heads in summer when most of the seeds in them are mature. Dry them on sheets, and then thrash or strip.

The varieties of parsnip are few in number. For shallow, stony or otherwise unfavorable soils the best varieties are the Round or Early Short Round; for better soils the Half-Long, Student, or Hollow Crown; and for deep clean soils the Long Smooth.

T. GREINER.

L. H. B.†

PARSÓNIA (after John Parsons, a Scotch naturalist). *Apocynaceæ*. Twining shrubs with opposite lvs.: calyx 5-parted, glandular or naked, or with 5 scales; corolla salver-shaped, tube short; lobes overlapping to the right; stamens inserted in the tube, filaments often twisted, anthers conniving over and adhering to the stigma, cells spurred and empty below; disk of 5 lobes or scales; ovary 2-celled, cells many-ovuled.—About 20 species in Trop. Asia, Austral., and New Zeal. The genus as here defined is that of Robert Brown; some recent authors have revived the older genus of the same name of Patrick Browne, making it supplant the usual species of *Cuphea* (p. 913). *P. Paddisonii*, R. T. Baker, is reported as under cult. It is a woody climber with glabrous sts., attaining a height of about 15 ft., and with stalked obovate-lanceolate lvs. This species produces tubers the size of beet-root, which are used as food by colonists as well as natives of New S. Wales. R.H. 1901:322 (note).

PARTHENIUM (ancient name transferred to this plant). *Compositæ*. About a dozen perennial or annual, mostly canescent or pubescent, rather coarse herbs or shrubs of the western hemisphere, only rarely taken to gardens and apparently not domesticated. The heads are only inconspicuously rayed and not specially showy, the ray-florets about 5. *P. integrifolium*, Linn., the AMERICAN FEVERFEW, or PRAIRIE DOCK, has been offered as an ornamental hardy herbaceous perennial, but the plant is desirable only for foliage effects; and the fls. are not attractive. It is pictured in B.B. 3:411 and described in American manuals; it grows on dry soils from Minn. to Ga.: stout, to 4 ft., from a tuberous rootstock: lvs. ovate or ovate-oblong; heads many in a dense corymb, the rays whitish. The so-called "guayule rubber" of Mex., *P. argentatum*, Gray, the difficulty of growing which has caused much discussion, is reported as being under cult. in Mexico City by M. Calvino. It is unknown in horticulture.

PARTHENOCÍSSUS (Greek, *parthenos*, virgin, and *kissos*, ivy; translation of its French name). Syn. *Quinária*, *Psédera*. *Vitaceæ*. Woody vines planted chiefly for their handsome foliage.



2765. Parsnip.

Deciduous or rarely evergreen shrubs climbing by means of tendrils with adhesive tips, rarely these tips not developed: bark with lenticels; pith white: lvs. alternate, digitate or 3-lobed, long-petioled: fls. in peduncled compound cymes opposite to the lvs., often crowded at the end of the branches and forming panicles, perfect, rarely polygamous; calyx minute, petals 5, rarely 4, spreading; stamens 5 or 4; style short and thick; a distinct disk wanting; ovary 2-celled, each cell with 2 ovules: fr. a 1-4-seeded berry.—About 10 species in N. Amer., Mex., E. Asia, and Himalayas. Formerly usually classed with *Ampelopsis*, which see for the differentiating characters between the allied genera.

These are high-climbing vines with handsome three- to seven-foliolate or three-lobed leaves assuming beautiful tints in autumn and with small greenish flowers in cymes or panicles followed by bluish black or black berries. They are particularly valuable as they cling firmly to walls and trees by means of adhesive tips of the tendrils without any other support. *P. quinquefolia*, *P. vitacea*, and *P. tricuspidata* are hardy North, while the other species are more or less tender; *P. Henryana* may be grown in the greenhouse for its beautiful foliage. In humid and good soil all species grow vigorously and soon cover large spaces. Propagation is by seeds or by hardwood cuttings or by layers, but *P. tricuspidata* and its varieties are usually grown from greenwood cuttings.

A. Lvs. 5-foliolate.

B. Young branchlets terete: lvs. green.

vitacea, Hitch. (*P. quinquefolia*, Graebn. *Ampelopsis quinquefolia* var. *vitacea*, Knerr. *A. dumetorum*, Hort. *P. dumetorum*, Rehd. *P. laciniata*, Small). Usually low and rambling over bushes, occasionally climbing high into trees, glabrous: tendrils with 3-5 twining branches only exceptionally ending in adhesive disks: the young growth green: lfts. oval or elliptic to oblong, acuminate, usually cuneate at the base, dark green and lustrous above, lighter green and usually lustrous below, coarsely serrate, glabrous, 2-5 in. long: cymes dichotomous on peduncles 1½-3 in. long, opposite the lvs.: fr. bluish black, about ½ in. thick, usually slightly bloomy, with 3-4 seeds. June, July; fr. July, Aug. E. Canada and



2766. *Parthenocissus quinquefolia*.—Virginia creeper. (×½)

New England to Assiniboia and from Mich. south to Texas and Colo. B.M. 2443. S.T.S. 1:89. Var. *laciniata*, Rehd. (*P. quinquefolia* var. *laciniata*, Planch.). Lfts. smaller, narrower, more deeply and incisely serrate, usually yellowish green. Wyo. to New Mex. Var. *macrophylla*, Rehd. (*Ampelopsis macrophylla*, Hort. *A. quinquefolia* var. *latifolia*, Dipp. *A. Røylei*, Hort.). Lfts. elliptic, large, dark green, sometimes 8 in. long and 5 in. broad. Garden form. Var. *dubia*, Rehd. (*P. hirsuta*, Graebn.). Young branchlets and lvs., at least on the veins beneath, more or less hairy.—This species is somewhat harder than the following, but does not cling to walls; it may be used for covering

trellis-work. The foliage is darker green and more lustrous.

quinquefolia, Planch. (*Vitis quinquefolia*, Lam. *Ampelopsis quinquefolia*, Michx. *A. hederacea*, DC. *A. virginiana*, Hort.). VIRGINIA CREEPER. Fig. 2766. High-climbing: tendrils with 5-8 branches ending in adhesive tips: the young growth purplish: lfts. elliptic to obovate-oblong, acuminate, usually cuneate at the base, coarsely and often crenately serrate, dull green above, glaucescent beneath: cymes crowded into terminal panicles: fr. bluish black, slightly bloomy, about ½ in. thick, with usually 2 or 3 seeds. July, Aug.: fr. in Sept., Oct. New England south to Fla. and Mex., west to Ohio, Ill., and Mo. Em. 2:535. S.T.S. 1:88. Var. *murorum*, Rehd. (*P. quinquefolia* var. *latifolia*, Rehd. *P. radicansissima*, Graebn. *Ampelopsis muralis*, Hort. *A. radicansissima*, Schelle). Tendrils with shorter and more numerous, usually 8-12 branches: lfts. generally broader, the outer ones usually broadly ovate and rounded at the base. This is a more southern form and somewhat tenderer. Var. *minor*, Rehd., is similar to the preceding variety, but lfts. smaller and broader, oval to orbicular-ovate, rounded at the base, on slender stalks about ½ in. long. Var. *hirsuta*, Planch. (*P. hirsuta*, Small. *Ampelopsis hirsuta*, Don. *A. Graebneri*, Bolle. *A. pubescens*, Schlecht. *A. quinquefolia* var. *radicansissima*, Rehd. *A. radicansissima*, Hort.). Young branchlets, inf. and the lvs. soft-pubescent, at least beneath, usually bright red while young, otherwise like the type. Gt. 48:1462. Var. *Saint-Paulii*, Rehd. (*P. Saint-Paulii*, Graebn. *Ampelopsis Saint-Paulii*, Hort.). Young branchlets and lvs. beneath pubescent: lfts. oblong-obovate, cuneate at the base, short-stalked or nearly sessile, sharply serrate with usually spreading teeth: panicles elongated: tendrils with 8-12 branches: aerial rootlets often present. Iowa and Ill. to Mo. and Texas. R.H. 1907, p. 567. Var. *Engelmannii*, Rehd. (*P. Engelmannii*, Graebn. *Ampelopsis Engelmannii*, Hort.), does not differ much from the typical form except in its generally smaller foliage.—The species is a very valuable climber of vigorous growth with the foliage changing to bright scarlet in fall; the varieties *hirsuta*, *Saint-Paulii*, and *murorum*, are particularly adapted for covering walls; they cling firmly and form a dense, close covering like *P. tricuspidata*, but grow more quickly and more straight upward than that species.

BB. Young branchlets quadrangular: lvs. usually with white markings above and purplish below.

Henryana, Diels & Gilg (*Vitis Henryana*, Hemsl. *Ampelopsis Henryana*, Hort.). Climbing to 20 ft. or more: tendrils with 5-7 slender branches with adhesive tips: lfts. 5, stalked, elliptic-ovate to cuneate-obovate, acuminate, toothed usually only above the middle, glabrous or hairy on the midrib beneath, 1½-2½ in. long, bright scarlet when unfolding, changing finally to dull reddish green, with silvery markings along the veins above, purple or purplish beneath: fls. in narrow panicles, 3-6 in. long: fr. dark blue, usually 3-seeded. Cent. China. G.C. III. 37:309; 39:354. Gn. 69, p. 341. M.D.G. 1908:259. R.H. 1907, p. 211. R.H.B. 32:213.—This is a very handsome but tender species; the coloring of the lvs. is more beautiful when grown in the greenhouse or outdoors in a partly shaded place; in the full sun the lvs. lose finally the white markings and the purple color.

AA. Lvs. partly 3-lobed and partly 3-foliolate.

tricuspidata, Planch. (*Vitis incansans*, Miq. *Ampelopsis tricuspidata*, Sieb. & Zucc. *A. Veitchii* var. *robusta*, Hort. *A. Hoggii*, Hort. *A. incansans*, Hort. *A. japonica*, Hort.). JAPANESE IVY. BOSTON IVY. Fig. 2767. High-climbing: tendrils short, much-branched, with adhesive tips: lvs. slender-stalked, cordate, either simple and 3-lobed with acuminate serrate lobes, to 10 in. long, or 3-foliolate; lfts. ovate, sessile, serrate,

shining and glabrous on both sides or puberulous on the veins beneath: cymes mostly on short branchlets, axillary or terminal, narrow and somewhat elongated: fr. bluish black, bloomy. June, July; fr. in Sept., Oct. Japan, Cent. China. B.M. 8287. G.C. II. 14:664. A.G. 15:94. B.H. 27:244. R.H. 1877, p. 176. Gng. 1:373; 4:353. R.B. 1877:11. Var. *Veitchii*, Rehd. (*P. Veitchii*, Graebn. *Vitis Veitchii*, Hort. *Ampelopsis Veitchii*, Hort.). Lvs. smaller, crenately serrate, purple while young; lfts. with only 1-3 coarse teeth on each side, the lateral ones inside without teeth. Apparently only a juvenile form which may pass later into the type. Var. *purpurea*, Hort. (*Ampelopsis Veitchii* var. *purpurea* or *atropurpurea*, Hort.). Lvs. dark purple, not changing to green. Var. *Löwii*, Rehd. (*Ampelopsis Löwii*, Hort. *Vitis incōstans* var. *Löwii*, Hort.). Lvs. small, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, mostly entire or 3-foliate, often broader than long, incisely dentate or almost palmately lobed with very unequal teeth, apple-green, purplish when young, changing to deep red in autumn. Gn. 71, p. 516. J.H. III. 56:335. R.H.B. 33:388. A.F. 30:1238. M.D.G. 1908:261. Var. *aurata*, Hort. Lvs. marbled with golden yellow and green.—This species is a hardy and very useful climber, clinging firmly and covering walls densely; the glossy foliage stands dust and smoke well, and turns to a brilliant orange and scarlet in fall. Probably the favorite of all hardy vines in cities. The varieties *Veitchii* and *Löwii* are much slenderer and smaller and are very effective as basket plants (M.D.G. 1892:8).

P. heptaphylla, Small (*P. texana*, Rehd. *A. quinquefolia* var. *heptaphylla*, Bailey. *A. heptaphylla*, Buckl.). High-climbing: tendrils with 2-4 branches without disks: lfts. usually 7, oblong-obovate, cuneate at the base, coarsely serrate, 1 $\frac{1}{2}$ -2 $\frac{1}{4}$ in. long: cymes dichotomous, opposite the lvs. Texas. S.T.S. 1:90.—*P. himalayana*, Planch. (*Ampelopsis himalayana*, Royle). Allied to *P. tricuspidata*: lft. 3, ovate to oblong-ovate, the lateral ones rounded or subcordate at the base, coarsely serrate, 2-5 in. long: cymes about as long as the lvs. Himalayas. Var. *rubrifolia*, Gagnep. (*Vitis rubrifolia*, Léveillé & Vaniot). Lfts. smaller and broader, purplish while young: cymes smaller. W. China.—*P. latifrons*, Rehd. Allied to *P. quinquefolia*. Tendrils with 5-8 slender branches: lvs. obovate or elliptic, coarsely serrate, bright yellowish green on both sides, 2-4 in. long, glabrous or hairy on the veins below: fls. in large terminal panicles. Cent. China.—*P. Thomsonii*, Planch. (*Vitis rubrifolia*, Laws. *P. Henryana* var. *glaucescens*, Diels & Gilg. *Ampelopsis Thomsonii*, Hort.). Tendrils with 3-5 disk-bearing branches: lfts. 5, slender-stalked, elliptic-ovate to elliptic-oblong, cuneate, serrate, glabrous or slightly pubescent on the veins beneath, bluish green, 1 $\frac{1}{4}$ -3 in. long: fls. in dichotomous cymes 1 $\frac{1}{4}$ -3 in. broad, opposite the lvs.: fr. black. Himalayas. Cent. China. Gn. 63, p. 203. J.H.S. 28, p. 216, fig. 184.—A very handsome slender vine; foliage purplish while young, and purplish red in fall. Tender.

ALFRED REHDER.

PARTRIDGE-BERRY: *Mitchella repens*. Sometimes applied to *Gaultheria procumbens*.

PASANIA (the vernacular name of one of the species in Java). *Fagaceae*. Ornamental trees grown for their handsome foliage.

Evergreen: winter-buds with few foliaceous scales: lvs. short-petioled, entire or dentate: staminate fls. in upright catkins, with a rudimentary ovary; stamens usually 12, much longer than the 4-6-lobed calyx; pistillate fls. solitary or 3-5, on separate catkins or at the base of the staminate catkins; ovary 3-celled, with 3 cylindric styles stigmatic only at the apex: fr. a 1-seeded nut, surrounded at the base or wholly inclosed by the cup, its scales distinct and imbricate or connate into concentric rings.—About 100 species in S. E. Asia, one in Calif. Closely related to *Quercus*, from which it is easily distinguished by the upright staminate catkins and the cylindric styles stigmatic only at the apex.—The *pasanias* can be grown in warmer temperate regions only and are little known in cult. Their treatment and propagation is the same as that of the evergreen species of oak.

densiflora, Oerst. (*Quercus densiflora*, Hook. & Arn.). **TANBARK OAK.** Evergreen tree, to 70, occasionally to 100 ft., with spreading branches forming a dense, broad, round-topped head: lvs. oblong-obovate or oblong, acute, remotely dentate, with short acute callous teeth,

fulvous-tomentose when young, at maturity glabrous and pale green above, rusty tomentose beneath and finally glabrous and bluish white: fr. peduncled; acorn ovoid or ovate, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, embraced only at the base by the shallow cup coated with linear spreading scales. S. Ore. to Calif. S.S. 8:438. G.F. 5:523.—One of the most beautiful oaks of the Pacific states. The bark is exceedingly rich in tannin and is used for tanning leather. The only representative of the genus in Amer.



2767. *Parthenocissus tricuspidata*. ($\times \frac{1}{4}$)

P. cornea, Oerst. (*Quercus cornea*, Lour.). Evergreen tree: lvs. oblong, acuminate, glabrous and green beneath, 2-4 in. long: frs. in short spikes; cup broadly turbinate with small prominent scales embracing the hemispherical flat-topped nut. S. China. H.I. 27:2665. The nut is edible. Young plants have proved hardy at Washington, D. C.—*P. cuspidata*, Oerst. (*Quercus cuspidata*, Thunb. *Castanopsis cuspidata*, Schottky). Evergreen tree, to 40 ft., with slender branches: lvs. ovate to oblong, acuminate, crenately serrate toward the apex or entire, glabrous at length, 1 $\frac{1}{4}$ -3 $\frac{1}{4}$ in. long: fr. in short spikes; cup ovate, inclosing the acorn. S. Z. 1:2. G.C. III. 12:233. S.I.F. 1:34. Very desirable evergreen tree of vigorous growth. Var. *variegata*, Hort. Lvs. smaller, with a broad, irregular, creamy white margin. G.C. II. 12:233.—*P. glabra*, Oerst. (*Quercus glabra*, Thunb.). Evergreen tree: lvs. oblong, obtusely acuminate, entire, glabrous, light green beneath, 3-6 in. long: fr. in spikes, ripening the second year: the oblong nut embraced about one-third by the cup. Japan. G.C. II. 14:785; III. 16:377. R.H. 1858, p. 351. S.I.F. 1:89. S.I.F. 1:32.—*P. thalassica*, Oerst. (*Quercus thalassica*, Hance). Evergreen tree: lvs. elliptic to obovate-oblong, acuminate, serrate toward the apex or entire, glaucous-tomentulose beneath, 3-5 in. long: fr. in short spikes; cup with appressed scales, embracing one-fourth to one-third of the nut. China. S.I.F. 1:33.

ALFRED REHDER.

PASCALIA: *Wedelia*.

PÁSPALUM (Greek, *paspalos*, an ancient name for millet). *Gramineae*. Spikelets 1-fl., plano-convex, mostly rounded, subsessile and overlapping in 2 rows on one side of a narrow or winged axis forming slender racemes. About 150 species in the warmer parts of both hemispheres, but more abundant in Amer., forming an important part of the pampas and campos of S. Amer. *P. dilatatum*, Poir., of Argentina, a coarse species 3-5 ft. high, is sparingly cult. as a forage grass in the Gulf states and has become naturalized throughout the S. *P. compressum*, Nees, CARPET-GRASS, a native, 6 in. to 2 ft. high, with creeping sts. and rather broad lvs. makes a good lawn grass in the Gulf region; it is less difficult to eradicate than Bermuda-grass. *P. distichum*, Linn. Extensively creeping rather wiry perennial, the erect fl.-culms 6-12 in., bearing a pair of divergent spikes. Occasionally used for lawns in the South. S. U. S. to S. Amer. *P. membranaceum*, Lam. Slender perennial with few to several spikes, the silvery spikelets arranged on a broad ribbon-like axis, banded with drab and orange. S. Amer. Cult. in Eu. under the name *P. elegans*; worthy of intro. A. S. HITCHCOCK.

PASSERINA (Latin, *sparrow*, from the supposed resemblance of the seed to the head of a sparrow; or possibly after one of the Passerinis, two Italian botanists). *Thymelæaceæ*. Heath-like shrubs sparingly used in horticulture: lvs. small, decussately opposite: fls. hermaphrodite, in axillary, branched spikes; perianth-tube ovoid, with 4 spreading lobes often about as long as the tube; stamens 8; ovary subsessile, glabrous, 1-celled.—About 5 species from S. Afr. *P. filiformis*, Linn. Branches puberulent: lvs. acerose-linear, 3-cornered, rather acute: spikes terminal, many-fl'd.; fls. rose; calyx-lobes oval or oblong. S. Afr.

PASSIFLORA (i. e., *passion flower*). Including *Disemma* and *Tacsonia*. *Passifloraceæ*. **PASSION-FLOWER**. Highly interesting herbs, shrubs, or trees, most of the cultivated kinds climbing by means of tendrils, with flowers of odd structure; some of them produce edible fruits.

Mostly vines, but some species erect: lvs. alternate, rarely opposite, the petiole usually gland-bearing, the blade entire, digitately lobed or parted, stipules sometimes present: tendrils (sometimes wanting) lateral, simple: fls. solitary or racemose, mostly axillary, on articulated and often 3-bracted peduncles, mostly hermaphrodite, with colors in yellow, green, blue and red, often large and showy; calyx with short tube (also with long tube when *Tacsonia* is included), the lobes or petals 4 or 5 and narrow, often colored inside, bearing on the throat a simple double or triple showy fringe or crown; petals 4 or 5 (sometimes wanting, or 3), attached on the calyx-throat; stamens 4 or 5, the filaments joined into a tube in which is the gynophore or stalk of the ovary, the anthers linear-oblong and versatile; ovary oblong or nearly globular, with 3 styles and 3 many-ovuled parietal placentæ: fr. large or small, berry-like, many-seeded, oblong or globular; seeds flat, mostly ovate, with a fleshy aril.—Species probably 250-300. By some, the genus *Tacsonia* is separated from *Passiflora*, but it is here combined; it differs in having an elongated rather than very short calyx-tube or hypanthium; Andean species. See *Tacsonia*.

With the exception of a few Malayan, Chinese and Australian species, the true *passifloras* are natives of tropical America, some of them in the sub-tropical and warm temperate parts. Many of them are cultivated as curiosities, and some of them for the beauty of their flowers and for their festooning foliage. The fruit is of many kinds, in most cases not edible. The ovary is supported on a long stalk, which is inclosed in or usually united with the tube formed by the union of the bases of the filaments. The structure of the fruit is well shown in Fig. 2768; the remains of the floral envelopes have broken from the attachment on the torus and rest on the fruit. A dozen *passifloras* occur in the United States, and one of them, *P. lutea*, grows naturally as far north as southern Pennsylvania and Illinois. From Virginia south, the Maypop, *P. incarnata*, is a very common plant in fields and waste places. Both these species are herbaceous perennials.



2768. Fruit of Maypop.—*Passiflora incarnata*. ($\times \frac{2}{3}$)

In cultivation, the *passifloras* have been considerably hybridized, and they are also confused with *Tacsonia*. In 1871 Masters enumerated 184 species (Trans. Linn. Soc. 27), but many species have been discovered since that time. Most of the *passion-flowers* are yellow or green in color of envelopes, but there are fine reds in *P. racemosa*, *P. Raddiana*, *P. coccinea*, *P. alata*, *P. vitifolia*, and others. The species known to gardeners are few, although many kinds are or have been in cultivation by fanciers and in collections. They usually require much rafter room in greenhouses. According to G. W. Oliver, *P. cærulea* and Constance Elliott are both hardy at Washington. Not many of the tender species and hybrids are grown to any great extent in this country. *P. alata* and *P. quadrangularis* are desirable climbers for a roomy warm greenhouse. *P. quadrangularis* var. *variegata* seems to flower quite as freely as the green-leaved one. *Passifloras* are propagated from cuttings of the half-ripened growth, with bottom heat. *P. racemosa* and *P. Loudonii* are a trifle difficult to root from cuttings; the growths should be as ripe as possible for this purpose. Keep the under surface of the leaves flat on the sand while rooting. The native *P. incarnata* grows very freely at Washington, becoming more or less of a weed and hard to eradicate.

The peculiar charm of these plants lies in the odd flowers, the parts of which were fancied by the early Spanish and Italian travelers to represent the implements of the crucifixion (whence both the technical and popular names). Legend and superstition have attached to these plants from the first. The ten colored parts of the floral envelope were thought to represent the ten apostles present at the crucifixion, Peter and Judas being absent. Inside the corolla is a showy crown or corona of colored filaments or fringes, taken to represent the crown of thorns, or by some thought to be emblematic of the halo. The stamens are five, to some suggestive of the five wounds, by others thought to be emblematic of the hammers which were used to drive the three nails, the latter being represented by the three styles with capitate stigmas. The long axillary coiling tendrils represent the cords or the scourges. The digitate leaves suggest the hands of the persecutors. The following sketch of the *passion-flower* legend is from Folkard's "Plant Lore, Legends and Lyrics," and the illustration (Fig. 2769) is also produced from that book: "The *passion-flower* (*Passiflora cærulea*) is a wild flower of the South American forests, and it is said that the Spaniards, when they first saw the lovely bloom of this plant, as it hung in rich festoons from the branches of the forest trees, regarded the magnificent blossom as a token that the Indians should be converted to Christianity, as they saw in its several parts the emblems of the passion of our Lord. In the year 1610, Jacomo Bosio, the author of an exhaustive treatise on the Cross of Calvary, was busily engaged on this work when there arrived in Rome an Augustinian friar, named Emmanuel de Villegas, a Mexican by birth. He brought with him, and showed to Bosio, the drawing of a flower so 'stupenduously marvelous,' that he hesitated making any mention of it in his book. However, some other drawings and descriptions were sent to him by inhabitants of New Spain, and certain Mexican Jesuits, sojourning at Rome, confirmed all the astonishing reports of this floral marvel; moreover, some Dominicans at Bologna engraved and published a drawing of it, accompanied by poems and descriptive essays. Bosio therefore conceived it to be his duty to present the *Flos Passionis* to the world as the most wondrous example of the *Croce trionfante* discovered in forest or field. The flower represents, he tells us, not so directly the Cross of our Lord, as the past mysteries of the Passion. It is a native of the Indies, of Peru, and of New Spain, where the Spaniards call it 'the Flower of the Five Wounds,' and it had clearly been designed by the great Creator that it might, in due time, assist in

the conversion of the heathen among whom it grows. Alluding to the bell-like shape assumed by the flower during the greater part of its existence (i.e., whilst it is expanding and fading), Bosio remarks: 'And it may well be that, in His infinite wisdom, it pleased Him to create it thus shut up and protected, as though to indicate that the wonderful mysteries of the Cross and of His Passion were to remain hidden from the heathen people of those countries until the time preordained by His Highest Majesty.' The figure given to the Passion-flower in Bosio's work shows the crown of thorns twisted and plaited, the three nails, and the column of the flagellation just as they appear on ecclesiastical banners, etc. 'The upper petals,' writes Bosio in his description, 'are tawny in Peru, but in New Spain they are white, tinged with rose. The filaments above resemble a blood-coloured fringe, as though suggesting the scourge with which our blessed Lord was tormented. The column rises in the middle. The nails are above it; the crown of thorns encircles the column; and close in the center of the flower from which the column rises is a portion of a yellow colour, about the size of a reale, in which are five spots or stains of the hue of blood, evidently setting forth the five wounds received by our Lord on the Cross. The colour of the column, the crown, and the nails is a clear green. The crown itself is surrounded by a kind of veil, or very fine hair, of a violet colour, the filaments of which number seventy-two, answering to the number of thorns with which, according to tradition, our Lord's crown was set; and the leaves of the plant, abundant and beautiful, are shaped like the head of a lance or pike, referring, no doubt, to that which pierced the side of our Savior, whilst they are marked beneath with round spots, signifying the thirty pieces of silver.' "

Passifloras as gardener's ornamental plants.
(J. J. M. Farrell.)

These plants constitute a large family or group of evergreen climbers. They will show to best advantage when they can be planted out permanently in a warm conservatory and where they can have comparatively large space to climb. They may also be grown in pots when the conditions do not permit other methods of handling.

Passifloras may be propagated either by cuttings or seeds. They may be rooted from young growth taken any time from the middle of January until April. These cuttings are placed in a warm propagating-bed, and kept shaded and moist, and in a short time they will root; they are also inserted in small pots in a mixture of loam, peat, and sand, in equal parts, and plunged in the propagating-bed. When rooted, the cuttings are potted off, using a compost of loam four parts, leaf-mold two parts, well-rotted cow-manure one part, and which should contain enough sand to keep it porous. Keep shaded until they become well established, when they may be given a place well up to the glass in full sun. The passifloras are also readily raised from seed sown in spring, and the plants potted off as soon as big enough.

The plants will stand a night temperature of 65° to 70°; this can be increased until it reaches 80° to 85° for a day temperature with sun. Give ventilation daily, taking into account the state of the weather; while they like plenty of heat, they will not do well in a stagnant atmosphere; therefore, give air on all favorable occasions. Every morning in bright weather, give them a good syringing, as this is a great aid in keeping them in vigor and supplying the desired atmospheric moisture, but this does not mean a very humid atmosphere. By pinching, the plants are made to produce several growths. These plants can be shifted until they are in 10- or 12-inch pots. The growth may be trained on pillars or along rafters of the conservatory.

When planted out in about 8 or 10 inches of soil, passifloras will cover a very large space, but sometimes to such an extent as to obscure the whole glass. The best place is on a back wall in some house where they may ramble at will. Keep well syringed until they show flower, when syringing should be discontinued until



2769. Old conception of the passion-flower.
From Folkard's "Plant Lore," and there taken from Zahn.

they are through blooming. After the plants have covered the position allotted to them, all that is required is the regulation of the young growth, so as to keep them from becoming entangled. In winter they may be cut back and the exhausted soil replaced by good rich compost. They will not need a high temperature, doing well in 55° to 60° at night. When they start off into growth again, keep raising the temperature until it has reached the figures already stated. They may now be given manure water regularly and throughout the growing season. Keep down thrip, red-spider, and mealy-bug by syringing and sponging.

The edible-fruited passifloras. (F. W. Popenoe.)

The principal species of Passiflora that are cultivated for their fruits in tropical and subtropical regions are *P. quadrangularis*, the granadilla, granadilla real of Costa Rica, barbadine of the French colonies, passionaria of Cuba, maracujá melão of Brazil; *P. edulis*, also called granadilla, as well as passion-fruit; and *P. laurifolia*, the water-lemon of the British West Indies, pomme-liane of the French colonies. While *P. quadrangularis* is a common garden plant in tropical America, it is not so extensively grown in any region as is *P. edulis* in Australia. In the United States these species can be grown only in the warmest regions; in California *P. edulis* is the only one that is successfully cultivated in the open, the other two species being much more susceptible to frost; in south Florida all three can be grown, although the tropical species are sometimes injured by frost.

The true granadilla (*P. quadrangularis*) is a strong rapid-growing climber, frequently planted for ornament in tropical regions and allowed to cover arbors and pergolas. Its brownish yellow ovoid fruits are sometimes 8 inches in length, and within the thin brittle pericarp is a large number of small flattened seeds surrounded by gelatinous pulp and subacid juice. When green, they are sometimes boiled and used as a vegetable; when ripe, the acidulous pulp is refreshing, and is used to prepare cooling drinks, or is eaten with a spoon directly from the fruit.

The passion-fruit (*P. edulis*) is considerably smaller than the granadilla, rarely larger than a hen's egg, and dull purple when ripe. Its pulp is slightly more acid than that of the granadilla, but of very pleasant flavor, and highly esteemed in Queensland and New South Wales, where the plant is cultivated commercially. It is used for flavoring sherbets, for confectionery, for icing cakes, for "trifles,"—a dish composed of sponge cake, fruits, cream, and white of egg,—for jams, and for other table purposes. The pulp is also eaten directly from the fruit, after adding a little sugar, or is used to prepare a refreshing drink, by beating it up in a glass of ice-water and adding a pinch of bicarbonate of soda. The plants are grown on trellises about 6 feet high; at the top of the trellis is nailed a crosspiece 18 inches long, from the ends of which are run two wires, the long branches being allowed to hang down over these to the ground. The rows are placed 15 feet apart, with the vines 15 feet apart in the row. The young plants must be protected in regions subject to frost; they begin bearing the second year, sometimes producing a few

which have not yet come into bearing. Like *P. quadrangularis*, this species is often grown as an ornamental plant, and makes an excellent and rapid-growing cover for fences and trellises.

The passifloras are easily propagated by seeds or cuttings, the latter method being preferable in most cases. Seeds should be removed from the fruit, dried in a shady place, and planted in flats of light soil. They do not germinate very quickly, but the young plants are easily raised, and may be set out in the open ground when six months to a year old. Cuttings should be taken from fairly well-matured shoots, and should be about 6 inches in length. They are easily rooted in sand, no bottom heat being required. Cuttings of *P. edulis* will often fruit in pots at the age of one to two years, and form very interesting greenhouse plants. While this species usually fruits prolifically, *P. quadrangularis* sometimes requires hand-pollination when grown outside its native habitat.

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I. PASSIFLORA proper, with short hypanthium or calyx-tube (species 1-24).

A. Corona with sharp folds, and crinkled at the edge.

B. Fls. apetalous, usually with no bracts.

1. *gracilis*, Jacq. Slender annual: st. terete, glabrous: lvs. rather small, broadly deltoid-ovate, very shallowly and bluntly 3-lobed: fls. solitary, pale green or whitish, considerably surpassed by the lvs., the calyx-lobes oblong or lanceolate, the filiform

rays of the corona in a single row and equal, the inner corona a lacerated membrane: seeds with 6 elevated ridges. Brazil. B.R. 870.—Fl. about 1 in. across. Easily grown either indoors or in the open, as a garden annual.

BB. Fls. petaliferous, with large bracts.

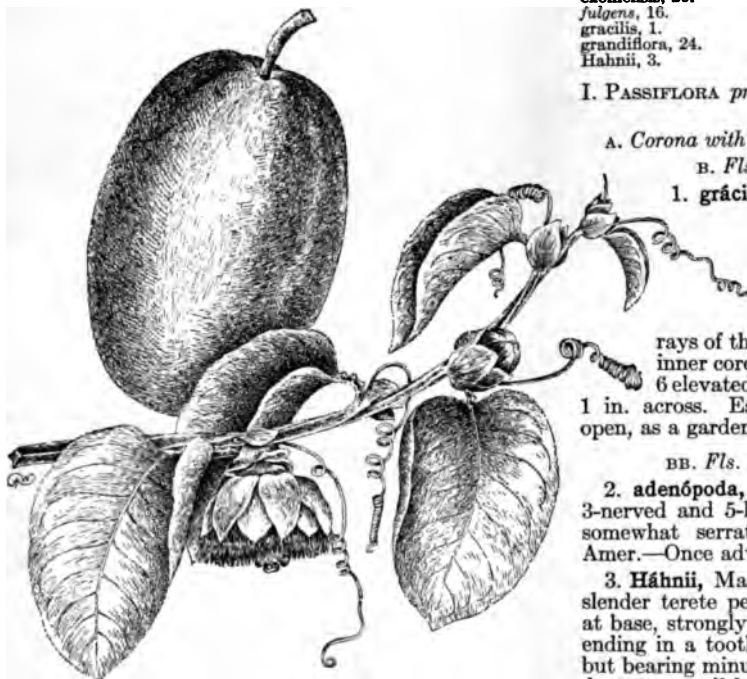
2. *adenopoda*, Moc. & Sessé. Lvs. glabrous, cordate, 3-nerved and 5-lobed, the lobes ovate-acuminate and somewhat serrate: bracts cut-serrate. Mex. to S. Amer.—Once advertised in the U. S.

3. *Hahnii*, Mast. Tall, glabrous climber, with very slender terete pendulous branches: lvs. ovate, peltate at base, strongly 3-nerved and each of the side nerves ending in a tooth, but the lf.-margin otherwise entire but bearing minute red glands: stipules kidney-shaped, dentate, purplish, nearly or quite 1 in. across: fl.-bracts 2, entire: fl. about 3 in. across, solitary, whitish and pale green, the corona shorter than the envelopes, the outer filaments being orange-yellow, about $\frac{3}{4}$ in. long. Mex. B.M. 7052. R.H. 1869: 430 (as *Disemma Hahnii*). G.C. II. 12: 504.

BBB. Fls. with small or minute petals and also small or minute bracts.

C. Lvs. oblong-ovate.

4. *trifasciata*, Lem. Lvs. 3-lobed to one-third or one-half their depth, the margins entire, with an irregular



2770. Granadilla—*Passiflora quadrangularis*. ($\times \frac{1}{4}$ — $\frac{1}{2}$)

fruits the first season, and continue in profitable production four to six years, when they must be renewed. By proper pruning, two crops a year can be secured, in regions not subject to frost. The most suitable soil seems to be sandy loam, although other soils will grow the plant successfully. Manure should be supplied liberally. In Australia, the profits of passion-fruit culture are reported to run from \$100 to \$300 an acre annually. Because of the short life of the vines, they are often planted as a catch-crop in young orchards

reddish purple band along each of the 3 midribs: fls. yellowish, fragrant, small. Brazil. I.H. 15:544. G.Z. 12:96.—Interesting for its ornamental foliage.

cc. *Lvs. broader than long.*

5. *lutea*, Linn. WILD YELLOW PASSION-FLOWER. Perennial herb, 5-10 ft. tall or long, glabrous or very nearly so: lvs. broader than long, shallowly and bluntly 3-lobed, cordate at base, the petiole glandless: fls. solitary or in pairs, about $\frac{3}{4}$ in. across, greenish yellow: fr. a globular berry about $\frac{1}{2}$ in. diam., smooth, purple at maturity. Pa. south and west, in thickets and more or less damp places. B.R. 79.—It has been offered by dealers in native plants.

6. *maculifolia*, Mast. Notable for its spotted or variegated foliage: branches slender and wiry, puberulous: lvs. short-stalked, roundish cordate, 3-nerved, with 3 shallow lobes at the truncate apex, green and yellow-blotched above, purplish and glandular beneath: fls. in pairs, cream-colored, nearly 1 in. across, the peduncles with 3 remote minute bracts; calyx cup-shaped, with acuminate recurved lobes; petals shorter than calyx-lobes or sepals; crown plicated and with hatchet-shaped processes. Venezuela. G.C. III. 32: suppl. Nov. 8.

AA. *Corona not crinkled or folded on the edge, plain or nearly so.*

B. *Bracts grown together.*

7. *ligularis*, Juss. (*P. Lövei*, Heer). Woody below, tall, branchy: lvs. large, cordate, ovate-acuminate, neither lobed nor toothed: fls. solitary, the petals and sepals greenish, the corona white, with zones of red-purple: fr. as grown in S. Calif. described as oval, larger and more oblong than that of *P. edulis*, with a hard shell and buff-brown in color. Trop. Amer. B.M. 2967.—Young foliage has metallic hues.

BB. *Bracts free.*

c. *Tube of fl. evident and cylindrical, swollen at the base.*

8. *racemosa*, Brot. (*P. princeps*, Hort. *P. amabilis*, Hort., in part). Lvs. glabrous, usually truncate at base, mostly deeply 3-lobed, the margins entire: fls. 4 in. or more across, the narrow petals deep red and wide-spreading, the short, upright crown purplish; calyx keeled on the lower side; fls. solitary, but the peduncles usually 2 from an axil, becoming racemose on the ends of the shoots: bracts 3: fr. described in cult. as cylindrical-ovate, greenish yellow at maturity. Brazil. B.M. 2001. B.R. 285. L.B.C. 1:84. Gn. 39:168. G.L. 24:222.—A fine old species and a parent of various garden hybrids. One of the best of the red-fl. passifloras. Summer and fall.

9. *Raddiana*, DC. (*P. kermesina*, Link & Otto). Rather slender climber, glabrous: lvs. shallow-cordate, 3-lobed and sparingly dentate, purplish beneath: fls. solitary, with very narrow distinct sepals and petals of a bright crimson-red, which are wide-spreading at first but finally turning almost straight back; crown black-purple, upright, with smaller whitish filaments inside. Summer and fall. Brazil. B.M. 3503. B.R. 1633. G. 1:453. F.W. 1874:161.—An old and well-known species; said to prop. from cuttings of old well-formed wood. *P. Loudonii*, Hort., is considered to be a hybrid of this and *P. racemosa*.

10. *Watsoniana*, Mast. Sts. wiry, purplish, with leafy dentate stipules: lvs. shallow-cordate, rather broader than long, 3-lobed to the middle, with a few teeth: peduncles 1-fl.; fls. about 3 in. across, the sepals linear and shaded with violet; petals also very narrow, lilac; crown of many rows of filaments, violet with bars of white below the middle, the inner and shorter set

deep violet. Probably Brazilian. G.C. II. 26:648, 649. I.H. 36:74. Gn. 33:194. A.F. 6:571.—Good grower.

cc. *Tube of fl. very short, thick or fleshy in substance.*

d. *Sts. and branches strongly 4-angled or even winged: lvs. simple.*

11. *quadrangularis*, Linn. GRANADILLA. Fig. 2770. Tall strong climber, glabrous: lvs. ovate or round-ovate,



2771. *Passiflora edulis*. (X34)

cordate at base, mucronate, entire, the petiole with 2 or 3 pairs of glands: stipules large: fl. large (3-5 in. across) and interesting, fragrant, with ovate sepals and petals (the former white within and the latter reddish), the crown composed of 5 series of white-and-purple part-colored filaments, of which the outermost exceed the floral envelopes: fr. oblong, 5-9 in. long, yellowish green, pulpy and edible. Trop. Amer. B.R. 14. R.H. 1898, p. 569. Gn. 51, p. 313; 59, pp. 4, 7. G. 33:161.—Widely grown in the tropics, and variable, both as a vine and for its edible frs. Frequent in collections of economic plants in the N. It is a good climber for covering a greenhouse roof. Best results are secured if the temperature does not fall below 50°. The fr. ripens in summer. The fls. usually need to be hand-pollinated if fr. is wanted on house-grown plants. Var. *variegata*, Hort. (*P. variegata*, Hort. *P. aucubifolia*, Hort.), has foliage blotched with yellow.

12. *alata*, Dry. St. winged: lvs. glabrous, oval to ovate, somewhat cordate at base, the margin often undulate but otherwise entire, the petiole with 2 pairs of glands: fl. 3-4 in. across, very fragrant, the interior of the sepals and petals carmine; corona nearly or quite as long as the envelopes, the numerous filaments part-colored with red, purple, and white: fr. yellow, ovoid-pointed, about 5 in. long, very fragrant and one of the most edible. S. Amer. B.M. 66. G.C. III. 15:19; 22:449-51; 43:187. R.B. 20, p. 104 (see R.H. 1902, pp. 287-9, for taxonomic discussion).—An excellent old species, ripening its fr. in midsummer. It is very variable, and is perhaps one form of a polymorphous species including the *granadilla*. *P. phoenicea*, Lindl. (B.R. 1603), *P. brasiliensis*, Desf., *P. oviformis*, Roem., *P. latifolia*, DC., *P. mauritiana*, Thouars, and *P. marseensis*, Presl., are all considered to be forms of this species. *P. Lawsoniana*, Hort., not Mast., is a hybrid of *P. alata* and *P. racemosa*: lvs. oblong-oval, somewhat peltate, entire: fls. 3-4 in. across, brownish inside, the corona with filaments in several series.

13. *Decaisneana*, Hort., is perhaps a hybrid of *P. quadrangularis* and *P. alata*: fls. bright carmine inside, about 4 in. across; corona as long as or longer than the

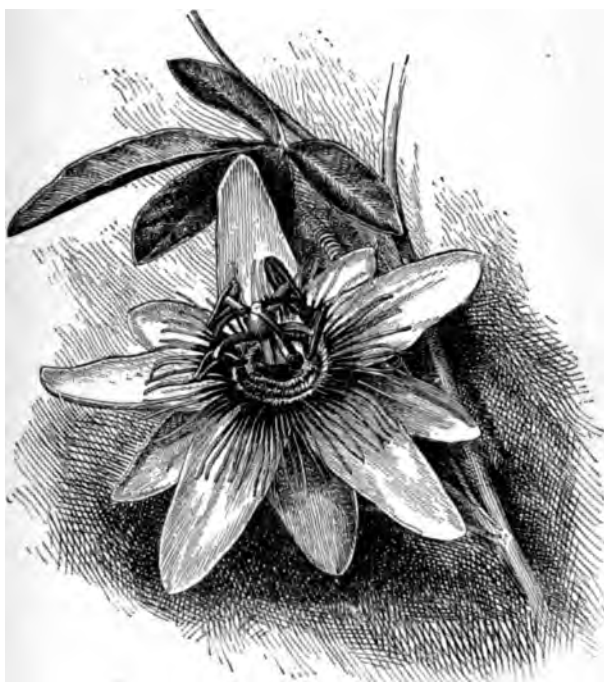
envelopes, the more or less tortuous filaments banded with deep blue and white: lvs. bearing about 6 glands. R.H. 1855:281; 1902:288 (as *P. Decaisneana* and *P. quadrangularis* var. *Decaisneana*, where a botanical and historical discussion by André may be found). F.S. 8:848.

DD. *Sts. and branches terete, or at least not winged.*

E. *Lvs. not lobed.*

14. *amabilis*, Hook. St. slender and terete: lvs. ovate, very sharp-pointed, entire, rather thin, the petiole with about 2 pairs of glands: fl. solitary, about 3 in. across, the sepals and petals alike and bright brick-red within; corona or white filaments in 4 series, the 2 inner series being short. Brazil. B.M. 4406. Gn. 55:272.

15. *laurifolia*, Linn. (*P. tinifolia*, Juss.). JAMAICA HONEYSUCKLE. WATER-LEMON. St. terete, plant glabrous: lvs. oval to oval-oblong, thickish, entire, with



2772. *Passiflora carulea*, the commonest cultivated passion-flower. (X29)

a short sharp point; petiole with 2 glands at apex: fl. about 2½ in. across, white, with red spots or blotches; corona somewhat exceeding the petals or at least about equaling them, in 3 series, violet with white bands: fr. about 3 in. long, yellow, spotted with white, edible, according to Lindley, but the plant cult. under this name in S. Calif. said to have frs. not yellow spotted white, but much like those of the plant there known as *P. ligularis* (see No. 7). Trop. Amer. B.R. 13. B.M. 4958.

16. *coccinea*, Aubl. (*P. velutina*, DC. *P. fulgens*, Wallis). Glabrous: lvs. ovate and coarsely toothed; petioles with 2-3 pairs of glands: fl. scarlet; corona orange: fr. pulpy, edible. S. Amer. G. 28:512. H.F. II. 6:6.—A free-flowering species, of good constitution.

EE. *Lvs. 3-7-lobed.*

F. *Blossoms bright red.*

17. *vitifolia*, HBK. (*P. sanguinea*, Smith. *Tacsônia Buchananii*, Lem.). St. shrubby, climbing, terete: lvs. cordate-ovate in outline, deeply 3-lobed or divided

and the divisions coarsely toothed, strong-veined, usually pubescent beneath: fl. 4-6 in. across, nearly flat, the linear-oblong sepals and petals bright scarlet, the sepals with a spine at the tip; outer corona filaments red, the inner ones white, all of them upright or spreading and much shorter than the envelopes. Brazil. B.M. 7936. F.M. 1878:317. G.C. III. 8:213; 43:187. G.Z. 28:145. F.W. 1868:289.—An old species, but not common in cult. Said not to be free-flowering. A very brilliant species.

FF. *Blossoms white, greenish, purplish, or variously tinted, but not red.*

G. *Rays of corona (or the outer ones) about as long as the floral envelopes: lf.-margins strongly serrate (except sometimes in No. 20).*

18. *incarnata*, Linn. WILD PASSION-FLOWER. MAY-POP. Fig. 2768. Tall-climbing strong perennial vine, glabrous or nearly so, becoming 20-30 ft. long: lvs. 3-lobed to about half their depth, broadly cordate-ovate in outline, serrate, the petiole bearing 2 glands near the top: fl. axillary and solitary, about 2 in. across, white, with a light purple corona band at its center: fr. oblong, about 2 in. long, with 3 sutures, yellow when ripe, edible. Dry places, Va., south and west. B.M. 3697. Mn. 9:17.—A weedy plant, but offered by dealers in native plants. With protection, the roots will survive the winter as far north as Baltimore, and the strong herbaceous vines make a fine cover for arbors and verandas. Easily grown from seeds.

19. *edulis*, Sims. Fig. 2771. More woody and stronger: lvs. large, deeply 3-lobed and serrate: fl. white, often tinted with purple, the rays nearly as long as the envelopes, white for the upper half but purple at the base: fr. globular-oblong, thickly purple-dotted when ripe, the rind hard. Brazil. B.M. 1989. R.H. 1857, p. 224; 1883, p. 489. Gn. 50:414; 62, p. 259. G.C. III. 23:101. A.G. 13:120.—Runs into several forms. The fr. is fragrant and edible, but there is little pulp, the seeds occupying most of the interior. Readily grown from seeds. Naturalized in tropical countries.

20. *pruinosa*, Mast. Climbing, the sts. terete, glabrous: lvs. broad in outline, 3-lobed beyond the middle, the lateral lobes diverging, the margins remotely glandular-toothed, glaucous beneath: stipules very large and lf.-like, cordate, 2 in. long: fl. 3 in. across, pale or pearly violet, the corona of numerous filaments, the outermost of which are nearly as long as the petals and are deep violet at the base, yellowish in the middle and curly at the top. British Guiana. G.C. III. 22:393 (desc.).—First described in 1897.

GG. *Rays distinctly shorter than envelopes: lf.-margins nearly or quite entire.*

21. *alba*, Link & Otto (*P. atomaria*, Planch.). St. terete: stipules very large and lf.-like: lvs. broad-ovate and somewhat cordate, rather shallowly 3-lobed, glaucous beneath, the margins entire: peduncles exceeding the lvs., 1-fld.; fl. little more than 2 in. across, clear white: fr. obovoid, the size of an egg, green at first, but becoming yellowish. Mex. to S. Amer. G.C. II. 19:693. R.H. 1883, p. 201; 1884:36. G.W. 14, p. 151.

22. *adenophylla*, Mast. By some thought to be probably identical with *P. alba*: lvs. glabrous, cordate at base, 3-lobed nearly to middle, glandular in the sinus, the lobes oblong and apiculate; petiole with sessile glands: fl. white, the peduncle equaling or exceeding the petiole; sepals bearing a subulate appendage near apex on the back; petals shorter than sepals and narrower. Mex.

23. *violacea*, Vell. Tall, glabrous, with drooping branches: lvs. straight at base and somewhat peltate, with 3 long, narrow lobes, of which the side ones stand at nearly right angles to the central one, the margins

entire or with a few teeth in the bottom of the sinus, the under surface slightly glaucous: fl. about 3 in. across, the petals and sepals lilac-pink inside (sepals ending in a long spur), the numerous filaments of the corona



2773. *Passiflora (Tacsonia) Van Volxemii*. Central leaflet broader than common. ($\times \frac{1}{2}$)

white-tipped and barred with violet and white. Brazil. B.M. 6997. R.H. 1885:468. G.W. 14, p. 151.

24. *cærulea*, Linn. Fig. 2772. Slender, but a strong grower, glabrous and somewhat glaucous: lvs. divided nearly to the petiole into 5 lanceolate or lance-elliptic entire sharp-pointed segms. of which the 2 lower ones are sometimes again lobed: fl. 3-4 in. across, slightly fragrant, greenish white, the sepals tipped with a short point, the rays of the corona in 2 series, blue at the tip, white in the middle and purple at the base, the styles light purple. Brazil. B.M. 28. Gn. 31, p. 421; 34, p. 114; 46, p. 369. G. 3:611. J.H. III. 47:57. — The commonest of passion-flowers in American green-houses, and now represented by several named forms and hybrids. It can be grown in the open in the S. and in Calif. as far north as San Francisco. Var. *grandiflora*, Hort., is only a somewhat larger-fl. form. Constance Elliott (*P. cærulea* var. *alba*), is a white-fl. fragrant form. G.C. III. 43:186. Gn. 31:420. There are hybrids with *P. Raddiana*, *P. racemosa*, *P. alata*, and others. *P. cærulea* grows readily from seeds.

II. *TACSONIA*, the hypanthium or calyx-tube long ($\frac{1}{2}$ in. long and usually much more).

A. Fls. orange or rosy orange.

25. *Párrita*, Bailey (*Tacsonia Párrita*, Mast.). Lvs. deeply 3-lobed, glabrous above, pilose beneath, lobes narrow and entire; stipules entire, subulate-acuminate:

fl. with a long and slender tube, glabrous, swollen at the base; sepals winged and with points, rosy-orange; petals oblong and flat, shorter than the sepals, orange; corona double, the outer row of tooth-like projections. Colombia. G.C. II. 17:225. I.H. 35:41. — Named for Senor Parra ("better known as Parrita"), through whom it was intro.

AA. Fls. scarlet or rose-colored.

B. Bracts beneath the fl. not united.

c. Lvs. simple or not lobed.

26. *insignis*, Hook. (*Tacsonia insignis*, Mast.). Pilose: lvs. ovate-lanceolate, subcordate, dentate, rugose or blistered above and red-downy beneath, the stipules dissected: fl. about 6 in. across, violet, rose or crimson; tube cylindrical, swollen at the base, downy; sepals about twice longer than the tube, lance-oblong, spurred at the end; petals similar in shape, obtuse; corona of one series of short threads, blue and white. Probably Peruvian. G.C. 1873:1113. F.S. 20:2083, 2084. B.M. 6069.

cc. Lvs. 3-lobed or divided.

d. Foliage glabrous at maturity.

27. *Van Vólxemii*, Triana & Planch. (*Tacsonia Van Vólxemii*, Hook.). Fig. 2773. Sts. slender and slightly pubescent: lvs. cordate-ovate in outline, deeply 3-lobed, the lobes long-lanceolate-acuminate, serrate: fls. 5-7 in. across, bright red with short green calyx-tube that has a swollen base, the acute calyx-lobes green externally; corona an inconspicuous toothed rim. Colombia. B.M. 5571. G.C. 1866:171. G.Z. 9:144. — Less showy than some others, but a well-known species.

28. *Jámesonii*, Bailey (*Tacsonia Jámesonii*, Mast.). Lvs. suborbicular, 3-lobed, glabrous: fl. large, bright rose or coral-red, with a cylindrical tube 4 in. long: fr. said to be green at maturity, oval. Peru.

DD. Foliage downy beneath at maturity.

29. *exoniensis*, Hort. (hybrid of *P. Van Volzemii* and *P. mollissima*). Fig. 2774. Lvs. downy, cordate, ovate-oblong, divided nearly to base into 3 lanceolate, serrate segms.: fls. $4\frac{1}{2}$ -5 in. across; sepals brick-red outside, brilliant rose-pink within; throat violet; tube white inside, $2\frac{1}{2}$ in. long. Resembles *P. Van Volzemii* in having peduncles as long as lvs., linear stipules, free downy bracts, filamentous corona near base of tube



2774. *Passiflora (Tacsonia) exoniensis*. ($\times \frac{1}{4}$)

and violet color of throat. Resembles *P. mollissima* in having downy lvs., long flower-tube, color of fl. and aristate sepals.

BB. Bracts beneath the fl. more or less united.

c. Lf.-lobes short, obtuse or nearly so.

30. *manicata*, Pers. (*P. ignea*, Hort. *Tacsônia manicata*, Juss.). RED PASSION-VINE. Fig. 2775. St. nearly terete, finely pale-pubescent: lvs. coriaceous, 3-lobed to about the middle, finely serrate, the lobes broad-oblong, pale beneath; stipules ovate, 1 in. across, notched, clasping; fls. solitary on slender axillary peduncles, brilliant scarlet, 4 in. across; perianth-tube $\frac{1}{2}$ in. long, inflated and 10-ribbed at base; outer corona of many short blue filaments, some of which surround the column; inner corona of an inflexed membrane: fr. egg-shaped or almost globular, yellow-green, the skin thick; seeds many in a thin pulp. Colombia, Ecuador, and Peru. B.M. 6129. G.F. 7:265 (from which Fig. 2775 is reduced). R.H. 1903:356.—This plant seems to be grown with difficulty in greenhouses, but it is at home in the open in S. Calif., climbing into the tops of trees and blooming profusely, making a brilliant display. It grows with great vigor and rapidity, renewing itself freely from seeds.

cc. Lf.-lobes long-acute.

31. *mixta*, Linn. f. (*Tacsônia mixta*, Juss. *T. eriantha*, Benth.). Glabrous or somewhat pubescent: lvs. orbicular-ovate, thick, 3-lobed to the middle, the lobes long-acute and serrate: fl. 3-4 in. across, rose-pink, the oblong sepals not equaling the green scarcely saccate tube; corona a short multiple rim or disk. Andes.—It is reported that the *P. mixta* that has been grown in Calif. is *P. mollissima*.

32. *mollissima*, Bailey (*Tacsônia mollissima*, HBK.). Pubescent: lvs. cordate-ovate in outline, very pubescent beneath, the lobes extending nearly to the base of the blade and ovate-lanceolate in shape and serrate, the stipules lacinate: fl. about 3 in. across, rose-color, the green tube exceeding the sepals and swollen at the base; corona a short rim. Andes. B.M. 4187. B.R. 32:11. F.S. 2:78. G. 28:17.—*P. tubiflora*, offered about 20 years ago in Calif. (and now apparently lost) is said not to differ much from *P. mollissima*.

33. *Smythiana*, Hort. Seedling of *P. mollissima* or hybrid with it, with very brilliant orange-scarlet or rosy-crimson fls. G.C. III. 12:705. Gn.W. 8:149.

P. alata-cerulea (*P. Pfordtii*, Hort.) is a hybrid from seed of *P. alata* by pollen of *P. cerulea*: lvs. much like those of *P. alata*, 3-lobed: fls. fragrant, beautiful; sepals white; petals pink; corona of 3 series, the outer filaments being white at tip, blue-purple in the middle, and black-purple at the base. B.R. 848. R.H. 1847:121.—*P. albo-nigra*, Hort. Said to be a hybrid of *P. alata* and *P. Raddiana*: lvs. 5-lobed: petals white; corona white above and blackish purple below. Gt. 1:68.—*P. Allardii*, Hort.=*P. quadrangularis* × *P. cerulea* Constance Elliott, raised by Mr. Allard of the Botanic Garden, Cambridge, England: lvs. usually with 3 broad lobes: free-flowering; petals white shaded pink; corona deep cobalt-blue.—*P. ambigua*, Hemsl. Possibly a hybrid of *P. laurifolia* and *P. maliformis*: fls. more than double the size of *P. laurifolia* (5 in. diam., pink and purple); petiole biglandular in middle: lf.-blades attenuate at base; stipules linear. Nicaragua. B.M. 7822. G.C. III. 31:171.—*P. atropurpurea*, Hort. Hybrid: has foliage of *P. racemosa*, but infl. and fl. in general shape more like *P. Raddiana*: fls. about 3 in. diam., tube less than $\frac{1}{2}$ in. long; sepals deeply keeled, reddish violet or prune-colored; petals about length of sepals, dark blood-red; outer corona violet spotted white, the filaments or threads half the length of the petals; inner corona shorter, violet, each thread enlarged at top. G. 26:495.—*P. Bellottii*, Hort. Sepals flesh-colored; petals rose; corona blue. Thought to be a hybrid of French origin, having been received in England about 1847.—*P. Bournapartea*, Hort., hybrid of *P. alata* and *P. quadrangularis*, "possessing the sweet-scented and richly colored fls. of the former with the handsome foliage of the latter:" blooms freely when young: fls. solitary in the axils, reddish crimson, the corona of rich red, white, and blue filaments. J.H. III. 51:253.—*P. capsularis*, Linn. Tall slender pubescent climber with red tendrils: lvs. with 2 lunate ovate-oblong lobes; fls. solitary, 2 in. across, rose-red; calyx-tube $\frac{1}{2}$ in. long, cylindric, the sepals narrowly linear-oblong and obtuse; petals narrower and paler; outer corona much shorter than petals, white; inner corona, short and incurved, white; ovary hairy. Brazil. B.M. 7751 (not 2868, which is *P. rubra*).—*P. chelidonea*, Mast. Lvs. oblong, forked at the end to

one-fourth the length and with a small middle lobe, marked with dots: fl. 2 in. across, greenish, with a folded corona. Ecuador. G.C. II. 12:40.—*P. cinnabarina*, Lindl. Branches terete: lvs. broad, ovate, 3-lobed, margins entire: fls. solitary, $2\frac{1}{4}$ in. across, red; corona short, folded, yellowish. Austral. G.C. 1855:724. B.M. 5911.—*P. coliménis*, Mast. & Rose. A Mexican species first described in 1899, but cult. for several years in Washington. It is an herbaceous species, with shallow-lobed obtuse denticulate lvs. and small whitish blue-marked fls. on single peduncles. Promising as an outdoor climber.—*P. euryphylla*, Mast. Lvs. oblong, very broad, rounded and biglandular at base, 2-lobed at apex with small lobe between, upper surface dull green and lower surface purplish: fls. whitish, not specially attractive. British Guiana.—*P. fétida*, Linn. (*P. hirsuta* and *P. hircina*, Hort.). Allied to *P. adenopoda*: annual or sometimes perennial: lvs. pubescent, 3-lobed, the margins entire or obscurely angled: fls. whitish, small, the corona as long as the petals and colored purple and blue: fl.-bracts pinnatifid. Trop. Amer. L.B.C. 2:138. B.M. 3635, the form known as var. *nigelliflora*, Mast.; and 288, the var. *ciliata*, Mast. Perhaps in cult., but apparently not offered in the trade. Variable.—*P. gubéna*, Mast. Sts. terete: lvs. lance-oblong, short-petioled, entire: stipules



2775. *Passiflora manicata*. (× about $\frac{1}{4}$)

ovate-pointed: fl. solitary on a long peduncle, 3 in. across, greenish yellow, the sepals and petals very narrow, the not folded corona short. Brazil. G.C. III. 20:555.—*P. Imthurnii*, Mast. Lvs. broad, oblong, acute, entire, thick, glabrous above, but not beneath: fl. erect, 4-5 in. across, brilliant scarlet and rose-color, with white in the center; corona very short. British Guiana. G.C. III. 23:307. Very showy.—*P. kewensis*, Hort. "It is a cross raised by Mr. Watson, the assistant curator, between the hardy *Passiflora cerulea* and the Brazilian *P. Raddiana*. The fls. are larger than those of *P. Raddiana*, the petals and fringe longer, while the color is carmine suffused with blue, which, though perhaps not so bright and pleasing as it is in the parent, is a lovely color."—*P. macrocarpa*, Mast. Of the *P. quadrangularis* group: st. 4-angled, strong-climbing: lvs. oval, obtuse: fl. white and purple: fr. as large as a small melon, weighing several pounds. Brazil.—*P. maliformis*, Linn. Of the granadilla section: st. described as cylindrical: lvs. ovate or ovate-oblong, entire, the petiole 2-glandular: fl. fragrant, large; petals white; corona blue: fr. yellow, round, and smooth, 2 in. diam., with agreeable pulp. W. Indies to S. Amer.—*P. Miensis*, Mast. Sts. slender and wiry: lvs. lance-ovate and entire, claret-colored beneath: fl. 2 in. across, white, shaded with pink, the corona half the length of the petals, white, barred with purple. Brazil. G.C. III. 4:353.—*P. militaris*, Hort. (*Tacsônia militaris*, Hort.). A showy winter-bloomer intro. from the Transvaal, supposed to be a hybrid of *P. manicata* × *P. insignis* or *P. Van Volxemii* × *P. insignis*: lvs. green and glabrous above, hairy beneath, deeply 3-lobed and sharp-serrate: fls. bright crimson taking on purplish tinge with age, 4-5 in. across, on hairy stalks 5 in. long; tube short, as in *P. manicata*, glabrous, inflated at base; outer calyx-lobes striped on outside, green in center, dull crimson on margins; corona small, purple; bracts 3 at base of tube, ovate, serrate.—*P. penduliflora*, Bert. Lvs. very broad, slightly 3-lobed: fls. yellow and green, solitary or twin, often pendulous; corona in 1 series and 12-

14-parted. W. India. B.M. 4565. J.F. 2:114.—*P. pinnatifidula*, Cav. (Tacsonia pinnatifidula, Juss.). Resembles *T. mollissima*, but the bracts are free; stipules pinnatisect; fls. rose-colored. Chile. B.M. 4062. B.R. 1536.—*P. punctata*, Linn. Herbaceous climber, minutely puberulous; lvs. nearly semi-circular or almost lunate, shallowly 3-lobed, the middle lobe much smaller, variegated on both surfaces with purple; fls. in pairs, pale yellow, about 1½ in. across; sepals ovate-oblong, obtuse, nearly ¾ in. long; petals similar but much shorter; corona in 3 rows, yellow, the filaments of the outer row with violet heads. S. Amer. B.M. 8101.—*P. quadrilobulosa*, Rodschied. Fls. solitary, 4-5 in. diam., rose-color with a darker shade in the center; corona with an outer ring of dark red filaments; inner filaments tubular and paler; sepals and petals much alike, very long and narrow, acuminate-pointed. Habitat unknown. G. 28:575.—*P. serratifolia*, Linn. Lvs. ovate-lanceolate, acute, serrulate, pubescent beneath; petiole 4-glandular; fls. purple; corona pale purple and bluish. Mex. B.M. 651. H.U. 2, p. 71.—*P. suberosa*, Linn. Glabrescent, with corky bark; lvs. roundish or ovate, 3-lobed, the lobes ovate to oblong to lanceolate, the petiole 2-glandular above the middle; fls. greenish yellow, without petals; corona short; berry ovoid, small. W. Indies, Venezuela, etc.—*P. triloba*, Ruiz & Pav. Lvs. large, cordate-ovate, 3-lobed or entire; fl. 3 in. across, with violet reflexed sepals and petals, and a long cuplike corona, with filaments banded white and purple. Peru. I.H. 36:83.—*P. Weberiana*, André. Glandular-hairy; lvs. large, 3-lobed, the margin usually toothed; fl. solitary, 2 in. across, white, the corona banded with white; fr. setose, purple. Argentina. R.H. 1887:324.

L. H. B.

PASTINACA (name from the Latin *pastus*, food). *Umbelliferae*. About a dozen species of tall herbs native to Eu. and Asia, by Bentham & Hooker united with the genus *Peucedanum*, but by Engler & Prantl and others kept distinct. It is distinguished from *Heracleum* and *Peucedanum* by technical characters of the fr. Fls. yellow, small, in compound naked umbels; calyx-teeth obsolete. *Pastinaca* is known to horticulturists in the parsnip (which see), *P. sativa*, Linn. It is a native of Eu., but is now grown in cool-temperate countries for its large edible root. In deep moist soil and a cool climate, the roots become 18-20 in. long and 4 in. or more in diam. at the crown. It was cult. before the Christian era. It has run wild from gardens, often becoming a bad weed in neglected fields and on roadsides. *P. sativa* is a robust biennial, sending up a grooved st. (which becomes hollow) 3-5 ft.; lvs. odd-pinnate, with 3-4 pairs of sessile ovate or oblong sharp-toothed and notched lfts. the terminal lft. 3-lobed; fr. ("seed") thin and flat, retaining its vitality only a year or two. When run wild, it loses its thick root, and sometimes it becomes annual.

L. H. B.

PATERSONIA (named for William Paterson, an English traveler). *Iridaceae*. Perennial herbs with short creeping rhizomes and rigid linear lvs. grouped in a distichous basal rosette; perianth-tube elongated; outer segms. obovate-cuneate, spreading; inner minute, erect; ovary clavate, 3-celled; ovules many, superposed; seeds angled by pressure.—About 19 species, all natives of Austral. *P. occidentalis*, R. Br. (*P. sapphirina*, Lindl.). Sts. very short; lvs. rigid, longest often over 1 ft.; scapes longer or shorter than lvs., dilated and striate under the spike; outer bracts 1½ in. long or more, prominently or rather obscurely keeled, inner bracts membranaceous, sometimes pubescent on the keel; fls. usually numerous; perianth-tube more or less villous; outer segms. often fully 1 in. long, broad and very obtuse, rich blue; inner segms. minute, ovate or lanceolate; style articulate near the base of the anthers. H.U. 1, p. 324.

PATRINIA (E. L. Patrin, 1742-1814, French traveler in Siberia). *Valerianaceae*. Yellow- or white-flowered valerian-like hardy herbaceous perennials, a foot or so high, blooming in early summer; resemble *Valeriana* and *Fedia*.

Glabrous or loosely villous herbs; lvs. once or twice pinnatifid or pinnatisect, the radical ones rarely entire; cymes corymbose-panicled; bracts narrow, free, but sometimes appendaged with a large 2-nerved and netted-veined bracteole which is appressed to the fr.; calyx with a small erect or spreading somewhat dentate limb; corolla-tube very short; lobes 5, spreading;

stamens usually 4; style nearly entire at apex; sterile locules of the fr. nearly as large or larger than the fertile ones.—About 15 species in extratropical Asia; little planted. They are of easy cult. in damp or shady places; bloom May to July. They are grown either in borders or in rockwork. Prop. by division of the roots and also by seeds.

scabiosæfolia, Fisch. St. glabrous; radical lvs. ovate or oblong, incised-serrate and lyrate; cauline lvs. pinnatifid, the lobes lanceolate-linear, acute, terminal one longest; fls. yellow; corymb loosely subpaniculate; fr. 3-cornered. Dahuria. L.B.C. 14:1340.

villösa, Juss. Coarse, 2-3 ft.; radical lvs. villous, petiolate, auricled; cauline lvs. sessile, dentate; corymb panicled, bearing white fls. Japan.

triloba, Miq. (*P. palmata*, Maxim.). Sts. erect, reddish, 8-16 in., simple below, pubescent at nodes and also on peduncles; lvs. cordate in outline, deeply palmately 3-5-lobed or the uppermost little if any lobed, margins coarsely toothed; fls. golden yellow, fragrant, in 3-branched cymes; corolla tubular, about ½ in. long. Japan. B.M. 8328. G.C. III. 46:244; same cut in III. 52:55.—Useful in rock-garden work. The lvs. are mostly at the base of the plant, the fl.-sts. rising about 4 in. above them; fl.-clusters 3-4 in. across.

gibbosa, Maxim. Differs from *P. triloba* in smaller fls., rather larger not cordate lvs. and st. not leafy; about 9 in. high; lvs. mostly radical and crowded, long-petioled, suborbicular, the upper ones round-ovate to ovate, acuminate, the base truncate or perhaps subcordate, pinnately lobed, the lobes incised-serrate; fls. yellow, the corolla distinctly gibbous at base; clusters flat; lvs. more or less blistered. Japan.

P. intermedia, Roem. & Schult. (*P. rupestris*, Bunge. *Fedia rupestris*, Hort.). 1-1½ ft.; lvs. pinnatifid, the segms. lanceolate with large terminal lobe; fls. yellow, fragrant, in May and June. Siberia. B.M. 714 (as *V. sibirica*).—*P. sibirica*, Juss. (*Valeriana sibirica*, Linn.). 1 ft., most of the lvs. radical, the cauline ones pinnate with entire segms., the radical long-spatulate, serrate, strong-toothed or entire (even on same plant); fls. yellow, fragrant. Siberia. B.M. 2325 (as *V. ruthenica*).

L. H. B.

PAULLINIA (probably after Simon Paulli, 1608-1680, professor of anatomy, surgery, and botany at Copenhagen). *Sapindaceae*. One species is a greenhouse climber, which may also be grown as an upright fern-like pot-plant.

Twining shrubs; lvs. alternate, stipulate, compound, 1-3-ternate or pinnate, or decomposed; petiole often winged; lfts. usually dentate, dotted or minutely lined; racemes axillary, usually with 2 tendrils; fls. whitish or pale, small; sepals 5, the 2 upper larger, connate; petals 4, but there is a fifth abortive one, two of the petals smaller and bearing a scale below the apex; stamens 8; ovary 3-celled, bearing a 3-parted style. Trop. Amer., and sparingly in Afr.; species about 140. Distinguished from allied genera, as *Cardiospermum*, by the septicidal fr., which is often pear-shaped. *P. thalictroides* is a handsome stove foliage plant, with much divided lvs. somewhat resembling a rue, maidenhair, or *davallia*. The fls. are inconspicuous, pinkish and borne in autumn. Forty to fifty years ago, when the interest in foliage plants was at its height, this plant was widely distributed. It used to be trained to a trellis for exhibition or grown on the pillars and rafters of hothouses. It is now a rare but choice plant for clothing the tops of unsightly tubs in which palms are growing. It is also excellent for large vases and stands the sun well. The young lvs. have a pretty bronze tint unless they are shaded too much. The plant is prop. by cuttings of young shoots taken in early spring. If the tops are pinched, the young plants will branch out and make handsome specimens in 4- or 5- in. pots.

thalictroides, Juss. Lvs. 4-10 in. long, triangular in outline, 3-ternately-pinnate; pinnae in 6-8 pairs; pinnales 4-8 pairs, 4-8 lines long; fls. inconspicuous, pink-

ish. Brazil. B.M. 5879. Gn. 51, p. 160. F. 1873, p. 124. J.H. III. 46:99. G. 7:153; 19:650. G.M. 46:397. Var. *argentea*, Hort., has foliage suffused silvery gray. L. H. B.

PAULOWNIA (after Anna Paulowna, princess of the Netherlands). *Scrophulariaceae*. Ornamental trees, grown for their beautiful flowers in showy panicles and for their large handsome foliage.

Deciduous, rarely half-evergreen: lvs. opposite, long-petioled, entire or sometimes 3-lobed or coarsely toothed, without stipules: fls. in terminal panicles; calyx campanulate, 5-lobed; corolla with long slightly curved tube, and spreading oblique 5-lobed limb; stamens 4: fr. a 2-celled caps., loculicidally dehiscent, with numerous small winged seeds.—About 8 species in China; in Japan only cult.

The paulownias are medium-sized or fairly large trees with stout spreading branches, large long-petioled leaves similar to those of catalpa, and violet or nearly white large flowers resembling those of the foxglove or gloxinia in shape, appearing in terminal panicles before or with the leaves and followed by ovoid pods remaining on the tree and conspicuous during the winter. *P. tomentosa* is fairly hardy in sheltered positions as far



2776. *Paulownia tomentosa*, showing verdurous growth of the young shoots.

north as Massachusetts, but the flower-buds are usually killed in winter, and it does not flower regularly north of New York City; plants raised from seed collected in Korea have proved hardier at the Arnold Arboretum than the commonly cultivated Japanese plant, also the var. *lanata* from Central China seems to be somewhat hardier. As an ornamental foliage plant it may be grown as far north as Montreal, where it is killed to the ground every winter, but throws up from the root vigorous shoots attaining 10 to 14 feet, with leaves over 1 foot and occasionally even 2 feet long. If used as a foliage plant and cut back to the ground every spring, the young shoots should be removed, except one or very few on each plant; during the first years of this treatment they will grow more vigorous every year, but afterward they will decrease in size, weakened by the continuous cutting back; they should then be replaced by strong young plants. Where the flower-buds which are formed the previous year are not killed by frost, the paulownia is one of the most conspicuous flowering trees in spring, and in summer the foliage, although it is of somewhat dull color, attracts attention by the size of the leaves. In temperate climates it is sometimes used as an avenue tree. It thrives best in a light deep

loam, and in a sheltered position. The other species are still little known in cultivation and are probably tenderer; they are great favorites with the Chinese and much planted in central and southern China. Propagation is by seeds sown in spring or by root-cuttings, and by greenwood cuttings under glass; it may be grown also from leaf-cuttings; the young unfolding leaves when about 1 inch long are cut off close to the stems and inserted in sand under a hand-glass in the propagating-house.

Paulownia tomentosa in southern California reaches a height of 40 feet in twenty-five years, with a spread nearly as great. When in full leaf it makes a dense shade. It starts to bloom before the leaves come and all is over before the tree is in full leaf. For this reason it is not a favorite. The jacaranda is a prettier blue, more floriferous, lasts three times as long, the blooms continuing until the tree is in full leaf. It is out of leaf not more than half as long as is paulownia and in mild winters holds much of its foliage throughout, being properly an evergreen. It makes as dense shade as the paulownia, has a prettier leaf and is more desirable in every way. The growth of the two trees is about the same at the end of a quarter century. The habit of the paulownia in retaining dry seed-pods on dead limbs 3 or 4 feet long is very unpleasant, and necessitates a thorough cleaning each year to the tip end of the uppermost branch—often a hard task to accomplish. (Ernest Brauntton.)

tomentosa, Steud. (*P. imperialis*, Sieb. & Zucc.). Fig. 2776. Tree, to 40 ft., with stout spreading branches forming a round or ovate head: lvs. rather long-petioled, broadly cordate-ovate, entire or sometimes 3-lobed, acuminate, pubescent above, tomentose beneath, 5-8 in. long or on vigorous shoots even larger: panicles to 10 in. long; fls. fragrant, pale violet, $1\frac{1}{2}$ -2 in. long; pedicels and calyx densely rusty tomentose; calyx-lobes short, rounded: caps. woody, broadly ovoid, pointed, 1 in. or somewhat longer. April, May. Cent. China, cult. in Japan. S.Z. 1:10. B.M. 4666. P.M. 10:7. Gn. 34, p. 79; 54, p. 476; 60, p. 130. G.C. III. 48:277; 51:430, 431. S.I.F. 1:85. H.U. 4, p. 102. R.H. 1907, p. 378. G. 35:769. Mn. 7, p. 171.—It is sometimes escaped from cult. in the southern states. Var. *pallida*, Schneid. (*P. imperialis* var. *pallida*, Dode). Fls. pale or whitish violet: lvs. dull green above. Var. *lanata*, Schneid. (*P. imperialis* var. *lanata*, Dode). Lvs. more densely yellowish tomentose beneath: calyx more tomentose with longer acutish lobes. Cent. China.

P. DuRoi, Dode. Tree, to 60 ft.: lvs. oblong-ovate, with open sinus at the base, tomentose below, to 1 ft. long: fls. about 3 in. long, pale lavender-purple, not spotted: calyx with acute tomentose lobes and glabrous or glabrescent tube; corolla rather gradually narrowed toward the base. Cent. and S. W. China.—*P. Fargesii*, Franch. Tree, to 60 ft.: branchlets usually pilose: lvs. pubescent or glandular above, slightly pubescent beneath, entire or with few coarse teeth: fls. lavender or whitish, $2\frac{1}{2}$ in. long: calyx tomentose outside with triangular acutish lobes. W. China.—*P. Fortunei*, Hemsl. Tree, to 20 ft.: lvs. sub-coriaceous, densely tomentose below, ovate or ovate-oblong, to 10 in. long: fls. to 4 in. long, white, spotted purple inside; calyx 1 in. long, glabrous outside except the acutish lobes; corolla rather gradually narrowed toward the base. S. E. China.—*P. Siféstrii*, Pampanini & Bonat. Small tree: lvs. densely brown-woolly, narrow, deeply cordate, 3-5 in. long: fls. in leafy panicles, sky-blue; calyx densely tomentose, with oblong obtusish lobes. Cent. China.—*P. thyrsoidea*, Rehd. Tree, to 20 ft.: branchlets and petioles pilose: lvs. ovate, usually truncate at the base, sparingly pubescent, often irregularly and remotely toothed, 4-6 in. long: fls. with the lvs., lavender, $1\frac{1}{2}$ in. long, in spike-like racemes forming terminal panicles about 1 ft. long; calyx tomentose, about $\frac{1}{4}$ in. long. Cent. and S. E. China. ALFRED REHDER.

PAVETTA (Malabar name of *P. indica*). *Rubiaceae*. Tropical shrubs and small trees closely allied to the brilliant ixoras but less showy, not often seen but deserving of attention; flowers white or greenish.

Leaves opposite or ternate, simple, sometimes part-colored, stipules present and joined at base: fls. in mostly terminal bracted corymbs; calyx top-shaped or bell-shaped, the limb mostly with 4 or 5 persistent or deciduous lobes; corolla usually salver-shaped, with a

cylindrical or funnel-shaped commonly slender tube, the throat mostly bearded or pubescent, the limb prevailing 5-parted (rarely 4-parted) into oval or oblong contorted lobes; stamens 4 or sometimes 5, affixed at the mouth of the corolla; style conspicuously exserted, the stigma entire or 2-toothed: fr. a pea-shaped somewhat fleshy 2-pyrenous berry.—One hundred or more species in the tropical and subtropical parts of the Old World, to the Philippines, with recent numerous extensions in Trop. Afr. Only a few of the species are in cult., and these are known as warmhouse or warm temperate plants.

The pavettas are fine tropical stove evergreens and should be more grown. *P. borbonica* can be propagated from half-ripened wood, leaving an eye and a leaf attached. These cuttings may be put into 2-inch pots, using a mixture of fibry peat and sand in equal parts. These pots may be plunged in a propagating-bed that has a bottom heat of 80° to 85°. Cover with glass so as to keep a humid atmosphere. It will take some little time before they make roots. Keep shaded and moist until this takes place. When roots are seen in the pots, gradually give more air until they are exposed to the full atmosphere of the house. They may also be propagated by being cut down well to make them throw many young soft cuttings that can be rooted with a brisk bottom heat. *P. caffra* will root freely from cuttings of young growth, placed where they have plenty of bottom heat. The pots may be plunged in the propagating-bed up to the rims. Keep shaded, moist and close for about a month. The best season for the increase of this class of plants is January to March.—The general culture for *P. borbonica* is to keep increasing the shifts until they are in 7- or 8-inch pots, using a compost of fibrous loam three parts, fibrous peat two parts, and well-decayed manure one part. Give each pot good drainage. In the spring and summer provide a night temperature of 70°, with 10° to 15° more by day with sun. Supply water when they show dryness of the ball. Keep well syringed. They will need some shade in the summer to keep the foliage perfect. In midwinter the temperature for night may be lowered to about 60°. *P. caffra*, which is a free bloomer, will need different culture. It should be kept growing by shifting as the plants may require, until they are in 6- or 7-inch pots or larger. For summer culture, treat the same as for *P. borbonica* only they will not need so much heat, 60° to 65° being sufficient, with 10° more during the day. They will stand pinching to make them bushy. The temperature in the winter should be from 50° to 55°. The following spring give more pot room and grow on the same as before. Give liquid manure at intervals in the growing season and by autumn they will show bloom. By giving root room, with liquid feeding and by heading in annually, they will bloom for years. Scale and mealy-bug thrive on pavettas, and the plants must be carefully watched. (J. J. M. Farrell.)

A. Foliage variegated.

borbonica, Hort. A foliage plant with unknown fls., referred arbitrarily to this genus: lvs. about 9 in. long, oblong-acuminate, rounded at the base, with a salmon-red midrib, mottled with light green on a dark green ground. Bourbon Isl. Lowe 5.

AA. Foliage not variegated.

B. Calyx-teeth setaceous and much longer than the tube.

caffra, Linn. f. (*Ixora caffra*, Poir. *P. corymbosa*, Houtt.). Shrub with whitish branches, to 6 ft., the branches terete and glabrous: lvs. almost sessile, obovate, glabrous (or in var. *pubescens*, Sond., branches and lvs. pubescent), the margins slightly recurved, to 2 in. long; stipules broad and cuspidate: fls. white, the tube $\frac{1}{2}$ in. long, in densely fld. corymbs; calyx-teeth $\frac{1}{2}$ in. long: fr. black and shining. S. Afr. B.M. 3580. Gn. 60, p. 414. J.F. 3:294.

natalensis, Sond. Shrub, glabrous, with young branches compressed: lvs. petioled, lance-acuminate, attenuate at base, shining, 3-4 in. long; stipules cuspidate-acuminate: fls. white, in a loose corymb. Natal.

BB. Calyx-teeth short-triangular, shorter than the tube, or sometimes practically wanting.

indica, Linn. A variable small tree or bush, common in India, extending to China and Austral.: glabrous, pubescent or tomentose: lvs. from elliptic to obovate or oblanceolate or even orbicular, at the apex from obtuse to caudate: fls. slender-stalked, white, fragrant, the corolla-tube $\frac{1}{2}$ - $\frac{3}{4}$ in. long: infl. corymb-like, terminal and sessile. B.R. 198, which is var. *polyantha*, Hook. f., with densely crowded pubescent fls. The species has many synonyms. L. H. B.

PAVIA: *Esculus*.

PAVONIA (J. Pavon, joint author of Ruiz and Pavon's "Flora Peruviana et Chilensis"; died 1844). *Malvaceæ*. Herbs or shrubs, one or two of which are sometimes grown under glass as pot subjects, for the showy bloom.

Tropical plants, tomentose, hispid or glabrescent: lvs. often angled or lobed: fls. of various colors, peduncled or crowded at the tips of the branches: bractlets 5 to many, distinct or more or less connate and resembling a calyx, usually not colored: calyx 5-cut or 5-toothed; petals spreading or convolute-connivent; staminal column truncate below the apex or 5-dentate; ovary 5-loculed, 1-ovuled: ripe carpels surrounding the axis and separating from it, rounded or truncate at top, sometimes winged, indehiscent or imperfectly dehiscent, prickly or awned.—Species about 100, Cent. Amer. to Argentina; also in Trop. Afr. and Asia, to Austral. and the Pacific. The genus is more or less confused with *Goethea*, but that genus, as usually defined, differs in its larger and more showy fl.-bracts and in the smooth carpels. The plants in cult. derive much of their interest from the showy bracts, although *Pavonia* is usually characterized as having bracts less conspicuous than those of *Goethea*.

multiflora, St. Hil. (*P. Wloti*, Morr. *Goethea multiflora*, Nichols.). Robust, with a stout usually simple st.: lvs. alternate, 6-10 in. long, narrowly oblong- or obovate-lanceolate, long-acuminate, serrate or denticulate: fls. in a short terminal corymb; bractlets beneath the fl. numerous, narrow-linear, whorled, red-hairy, curving, in length about equaling the rolled-together purple corolla (which is 1-1½ in. long); calyx-segms. much shorter than the bractlets; column of stamens 2½ in. long and prominently exserted. Brazil. B.M. 6398. F.M. 1877:276.—What is known as *P. intermedia* by gardeners is apparently not *P. intermedia*, St. Hil.; it is said to be derived from *P. multiflora*. There are forms of *P. intermedia*, Hort., known as var. *rosea*, var. *floribunda*, and var. *kermesina*. This group of plants is readily grown from cuttings taken in spring or early summer, and good blooming plants in 5-in. pots may be had by winter. They grow naturally to about one st., and should not be pinched back. They make attractive pot subjects with the terminal clusters of fls. marked by the long-protruding staminal column with hanging bluish anthers, the narrow rolled corolla and the slender conspicuous bracts.

spinifex, Willd. Shrub, to 20 ft., from S. Amer., the st. slender, branches few and virgate: lvs. ovate, cordate, crenate sometimes angled, pubescent on both surfaces: fls. large, yellow, not fragrant, the corolla open; petals obovate; calyx-lobes lanceolate: bractles 5 or more, linear, hairy on margin: caps. with 3 spines. B.R. 339.

præmorsa, Cav. Shrub with rodlike branches, from S. Afr.: lvs. broad-ovate or fan-shaped, truncate, obtusely dentate, canescent beneath, with petiole and

setaceous stipules: fls. bright yellow and dark-centered, single on axillary pedicels exceeding the lvs., with 12-14 linear involucre bracts: fr. of downy carpels.—This and *P. spinifex* are reported in Calif.

P. Makoyana, Morr. (*Goethea Makoyana*, Hook.). Lvs. elliptic, short-stalked, with large stipules: fls. in terminal clusters, subtended by large cordate-ovate crimson bractlets. Brasil. B.M. 6427. G.Z. 22:169.—*P. semperflorens*, Garcke (*Goethea semperflorens*, Nees & Mart.). Tall: lvs. elliptic, serrate: fls. usually terminal, purple, with brown bractlets. Brasil. L. H. B.

PAWPAW: *Carica Papaya* and *Asimina*.



2777. Garden pea, American Wonder. The illustration shows an entire plant, cut off at the surface of the ground. (×½)

PEA. As known to horticulturists, the pea is the seeds and plant of *Pisum sativum* and its many forms, one of the Leguminosæ, grown for its edible seeds and sometimes for the edible pods. (Figs. 2777-2783.)

The garden pea is native to Europe, but has been cultivated from before the Christian era for the rich seeds. The field or stock pea differs little from the garden pea except in its violet rather than white flowers and its small gray seeds. There are many varieties and several well-marked races of garden peas. Whilst peas are grown mostly for their seeds, there is a race in which the thick soft green pods, with the inclosed seeds, are eaten. The common or shelling peas may be separated into two classes on the character of the seed itself,—those with smooth seeds and those with wrinkled seeds. The latter are the richer, but they are more likely to decay in wet cold ground, and therefore are not so well adapted to very early planting. Peas may also be classified as climbing, half-dwarf or showing a tendency to climb and doing best when support is provided, and dwarf or those not requiring support. Again, the varieties may be classified as to season,—early, second-early, and late. Vilmorin's classification (*Les Plantes Potagères*) is as follows:

- A. The pea round (smooth).
- B. Plant climbing.
- c. Seed white.
- cc. Seed green.
- BB. Plant half-dwarf.
- c. Seed white.
- cc. Seed green.
- BBB. Plant dwarf.
- c. Seed white.
- cc. Seed green.
- AA. The pea wrinkled (divisions as above).

PEA

Left to themselves, the varieties of peas soon lose their characteristics through variation. They are much influenced by soil and other local conditions. Therefore, many of the varieties are only minor strains of some leading type, and are not distinct enough to be recognized by printed descriptions.

Garden or green peas.

Peas are one of the earliest garden vegetables to reach edible maturity. The date at which a mess of green peas could be gathered used to be regarded as an indication of a man's horticultural ability. In modern times, green peas grown far away to the South come to northern markets while the ground is still frozen and are eagerly purchased only to result in disappointment and a longing for the old-time quality. Such disappointment is inevitable, for even with refrigerator cars, express trains, and modern skilful handling, green peas grown hundreds of miles away cannot come to our tables for many hours, often not for days, after they have been gathered, and with an inevitable loss of the freshness, which is essential for satisfactory quality.

Peas do well in cool moist weather and will germinate and make a slow but healthy and vigorous growth in lower temperatures than most garden vegetables. The young plants will even endure some frost with little injury, but the blossoms and young pods will be injured or killed by a frost which did not seem materially to check the growth of the plant. For this reason it is generally most satisfactory to delay planting until there is little probability of a frost after the plants come into bloom.

The cultural requirements are simple, but a thorough preparation of the soil before planting is desirable, and the use of green and fresh manure should be avoided. The best depth of planting varies with the season and character of the soil, and early plantings on clay land should be covered only 1 to 2 inches deep, while later plantings on sandy land do best in drills 6 or 8 inches deep to be gradually filled as the seedlings grow. Generally anything more than surface tillage will do a growing pea crop more harm than good; but any crust formed after rains, particularly while the plants are young, should be promptly broken up.

Of the better garden sorts, from fifty to one hundred good seeds are in an ounce, and a half-pint should plant 50 to 80 feet of row and furnish a sufficiency of pods for a small family for the week or ten days in which they would be in prime condition. For a continued supply one must depend upon repeated plantings.

Most of the best garden varieties can be well grown without trellising, but the sorts growing over 2 feet high will do better if supported. Nothing better for this purpose is known than brush from the woods, but this is not always available and a good substitute is the wire pea trellis offered by most dealers in horticultural supplies, or a home-made one made by strings stretched 2 to 4 inches apart on alternate sides



2778. Garden pea, Champion of England. (×½)



LXXXV. Good pods of the garden pea, variety Peter Pan.



of supporting stakes. The ingenuity of the home-gardener will devise good forms of trellising.

It is evident that green peas occupy too much ground to be a practical crop for a city lot or small town garden, and generally the town dweller can be most satisfactorily supplied from a nearby market-garden; and the great superiority of freshly gathered local-grown peas over those which have to be shipped in make this one of the best of crops for a gardener with permanent customers. The best cultural methods for field plantings do not differ materially from those given for the garden. No planting is so likely to give a satisfactory yield both as to quantity and quality as on an old clover sod on a well-drained clay loam, which should be well plowed in the fall or early winter and the surface worked into a good tilth as early as practicable in the spring.

Planting can be best done with a seed-drill so arranged that the rows are 12 to 36 inches apart, according to the variety, with occasional rows left blank for convenience in gathering.



2779. Garden pea, Nott Excelsior. ($\times \frac{1}{2}$)

Picking should be done after sundown or in early morning before nine o'clock and care be taken not to bulk the pods, as they are liable to heat and spoil.

Peas for canning.

There is no modern industry in which there has been greater improvement within the past ten or more years, both as to methods and the quality of the product, than in the canning of vegetables. This is especially noticeable in canned peas. First there has been a great betterment as to the varietal quality of the stock used. For canning, particularly when modern methods of harvesting and processing are used, it is important not only that the green peas be sweet and palatable, but that the largest possible proportion of the pods shall be in prime edible condition at the same time, and canners are influenced by these qualities in selecting varieties for their plantings, and in the cultural methods followed. The development of each planting is closely watched by an expert, who directs that it be cut and delivered at the factory on the day when he judges it will be in the best condition, the time for individual crops being sometimes modified by the capacity of the farmer to deliver and the factory to handle it. Not infrequently certain crops are left to ripen and be harvested as grain because of such conditions. In hot and

sunny weather, the vines are cut either after five in the afternoon or before nine in the morning, hauled to the factory and from the wagon go direct to a specially constructed threshing-machine or "viner," which separates the peas and delivers them on a moving inclined belt, which throws out any bits of vines or pods. They are then washed and graded, and go to the processor. So promptly is this work done that it is known of peas being in the cans and being cooked before the wagon on which they were brought from the field could start for home. Usually peas put up by a well-managed cannery come to the table in more palatable condition than so-called fresh peas which were gathered ten to twenty-four hours before and shipped from 10 to several hundred miles to market.

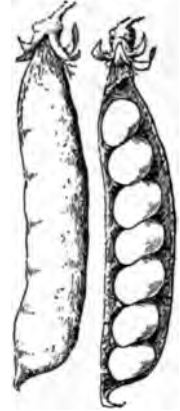
Canners who are particular as to the labeling of their output often separate it into different grades, determined by the variety and size of peas and labeled somewhat as follows:

Varieties	1st	2nd	3rd	4th
Small, smooth seed, not over.....	16/64	18/64	20/64	Run of crop
Small, wrinkled seed, not over.....	18/64	20/64	22/64	Run of crop
Large, smooth seed, not over.....	20/64	22/64	24/64	Run of crop
Large wrinkled seed, not over.....	20/64	24/64	26/64	Run of crop

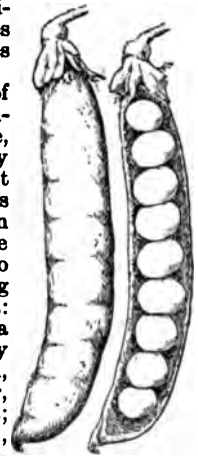
Varieties and seed.

Few vegetables have developed greater varietal differences affecting their horticultural or culinary value than garden peas. As to vines, there are sorts from 6 inches to 6 feet in height and those which very rarely form more than a single stem, while others are so branched that they often are wider than tall; some mature their crop very early and all at once, others not until the vines are fully grown or continuing through a long season; pods which are so broad and long that the inclosed peas never fill them, others in which the growing peas very often split the pod open; peas which are green, yellow or white, smooth and hard; others which are wrinkled, distorted and comparatively soft, even when fully mature. Very conspicuous variations of little practical importance are sometimes correlated with invisible qualities which are of great importance.

When grown for seed, peas of the garden varieties yield a comparatively small fold of increase, seldom over 10 or 12 and often only 2 or 3, so that it is more difficult than with most vegetables always to secure full supplies of certain sorts, and seedsmen's stocks are constantly changing, not only as to character but name. The following are now very popular varieties: Extra-early smooth-seeded—Alaska or Prolific Extra Early; early wrinkled seeded—Thomas Laxton, Gradus, Surprise; dwarf Excelsior, either the Notts or the Suttons; midseason—Advancer, Admiral, Senator; late—Champion of England, Strategem. However, one should confer with the seedsmen



2780. Pea, Nott Excelsior. ($\times \frac{1}{2}$)



2781. Pea, Pride of the Market. ($\times \frac{1}{4}$)

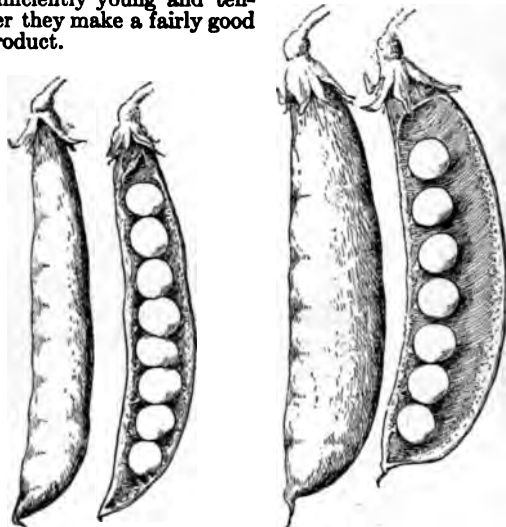
as to the most available stock best suited for the particular needs.

Sugar or edible-podded peas.

These are a class little known in this country, but are largely grown in Europe. They are characterized by large more or less fleshy and often distorted pods, which are cooked when in the same stage of maturity and in the same way as string beans. Varieties have been developed in which the pods are as white, tender, and wax-like as those of the best varieties of wax-podded beans.

Field peas.

There are a number of kinds of field peas in which the vines are very vigorous, hardy, and productive and the peas generally small, hard, and becoming tough, dry, and unpalatable as they ripen. In one variety of this class known as French Canner, the very young and small peas are sweet and tender, and in this stage are put up by French canners under the name of "petit pois." The larger-seeded Marrowfat peas were formerly commonly used by canners, and large quantities are still packed. If this is done while the peas are sufficiently young and tender they make a fairly good product.



2782. Pea, Stratagem.
($\times \frac{1}{2}$)

2783. Pea, Melting Sugar.
($\times \frac{1}{2}$)

Split peas.

Large quantities of field peas, mostly of the smaller-seeded kinds, are used for split peas, the preparation of which consists in cleaning and grading, kiln-drying, splitting, and screening out the hulls and chips from the full half peas. This is all done by special machines, mostly of American invention. The annual consumption of split peas in the United States is about 50,000 barrels, of which, before the European war, 75 per cent came from abroad.

W. W. TRACY.

PEA. *Congo P.*, *Cajanus indicus*. *Everlasting P.*, *Lathyrus latifolius*. *Glory P.*, *Clanthus Dampieri*. *Hoary P.*, *Pigeon P.*, *Cajanus indicus*. *Scurfy P.*, *Psoralea*. *Sweet P.*, *Lathyrus odoratus*.

PEACH. The tree and fruit of *Prunus Persica* (or *Persica vulgaris*), widely cultivated in the United States and parts of Canada for home use and market.

In the northern prairie states and on the plains, and in the colder parts of the mountain regions of the West, the peach is little grown or is even altogether absent; yet the range of adaptability is constantly extending as the local conditions and requirements become better known. There is less dependence on

"fruit-belts" than formerly, in which some special favor of climate or location was supposed to exist. Some parts of New England are well adapted to commercial peach-culture. Parts of Canada bordering the Great Lakes, and regions in Nova Scotia, are prominent peach districts. Varieties of special adaptability to climate and useful also for particular purposes have arisen in recent years; and the requirements of the peach are now better understood than formerly. The range of its cultivation will probably be considerably broadened in years to come.

The discussion of the peach is here comprised in four articles:

	Page
The culture of the peach (M. A. Blake).....	2492
Peach-culture in the South (J. H. Hale).....	2500
Peach-growing in California (George C. Roeding).....	2503
Protecting peach trees in cold climates (W. Pad-dock).....	2504

The culture of the peach.

The marked feature in the development of the peach industry in the United States since about 1900 has been the extension of the areas of commercial peach-production because of the introduction of hardier varieties such as Carman, the discovery of materials and methods that make certain the control of peach-scab and brown-rot, and the organization of fast-freight and refrigerator-car service that permits of successful long-distance shipment of this perishable fruit.

The introduction of the San José scale was the cause of the destruction of hundreds of thousands of peach trees throughout the country from about 1900 to 1907, the period of greatest damage varying to some extent in each district. The growers who persisted in the business were those who had the capital, energy, and persistence to take up the new problem of spraying, and these men may appropriately be termed the pioneers of the modern peach business.

The necessity of spraying to control the scale also focused the attention of the growers upon all other factors of peach-production except marketing, which for the time presented few difficulties because of the great reduction in the number of bearing trees and the ability of the local markets to absorb much of the crop produced.

Peach-scab and brown-rot caused serious damage to the crop annually in central and southern peach districts until the self-boiled lime-sulfur summer spray was proved to be a successful remedy.

The development of large commercial areas at long distances from market has resulted in better grading and packing. The Georgia six-basket carrier has become the popular shipping package from southern New Jersey to Georgia, Alabama, and Texas. (Fig. 2707.)

Innumerable changes and improvements in the growing and handling of the crop have occurred within the last ten years.

The United States Census reports show many interesting facts in connection with the extent and development of the peach industry. A few trees are found in every state in the Union. According to the Census of 1910 only three states, Wyoming, North Dakota, and Montana, have less than 5,000 trees. Five other states, Minnesota, South Dakota, Wisconsin, Maine, and Vermont, have less than 10,000 trees. The most significant fact, however, is that twenty-six states reported a total of more than 1,000,000 bearing trees each, which definitely shows the extended area over which this crop is produced to some commercial degree. The Census for 1910 shows Georgia to lead in the total number of bearing trees with 10,609,119; Texas is second with 9,737,827; and California is third with 7,829,011 trees. On the basis of total number of trees, however, Texas leads with 12,696,640; California is second with 12,238,573, and Georgia is third with 12,140,486.

The Census reports also indicate the general trend of the industry in no uncertain way. In 1890, five states led prominently in the total number of bearing trees, as follows: Maryland, 6,113,287; Kansas, 4,876,311; Delaware, 4,521,623; Texas, 4,486,901; and New Jersey, 4,413,568. The greatest peach district in the



2784. Peen-to peach.—*Prunus platycarpa*. ($\times \frac{1}{4}$)

country at that time was comprised by the states of Maryland, Delaware, and New Jersey, with a total of more than 15,000,000 trees.

The three leading states in 1900 were, Michigan with 8,104,415 trees, Georgia with 7,668,639 trees, and California with 7,472,393 trees. The states of Maryland, Delaware, and New Jersey, which geographically comprise one district, reported a total of a little more than 9,000,000 trees, the San José scale and other factors having reduced the total about 6,000,000 trees. Yet as a peach district, this still held its place as having the greatest total number of trees.

The Census of 1910, however, shows that this number was greatly reduced during the period from 1899 to 1909, having less than 4,000,000 bearing trees. This great reduction and loss was due largely to the introduction of the scale. Michigan reports a loss during this period of more than 5,000,000 trees, and Ohio more than 3,000,000. The following states made gains during this period: New Hampshire, Vermont, Illinois, Idaho, Missouri, Nebraska, South Carolina, Georgia, Tennessee, Alabama, Arkansas, Louisiana, Texas, Colorado, New Mexico, Utah, Washington, and California. Summarized to a few words, the Census indicates that while the Middle Atlantic and Great Lakes districts were suffering severe destruction of trees, the southern and western districts were developing. These facts lead one to wonder as to how much of a part the San José scale played in the development of these latter districts, and whether such development could have maintained itself in some cases without the good markets and high prices occasioned by the widespread destruction of trees in the East.

The Census of 1910 is of particular value in showing the recent trend of the industry, because the number of trees in bearing and those not in bearing were tabulated separately.

The western states, Idaho, Oregon, Utah, and Washington are increasing their plantings. The young trees not in bearing in Massachusetts, Michigan, and New Jersey were greatly in excess of those producing fruit in 1909. West Virginia has also been planting peaches extensively in recent years.

The extensive planting of peaches in the eastern and Middle Atlantic states, following the earlier destruction by yellows, was only just beginning in 1909, when the last Census was taken. Since that time, millions of trees have been planted and have come into bearing. As a result, the marketing factor became the most important peach problem in 1915. Southern districts can no longer expect the prices of former years in the great eastern markets, the Middle West is growing quantities of peaches and so also are the states along the Great Lakes. The problem at the

beginning of 1916 is where and how can the crops from these trees be marketed profitably.

In any broad discussion of the peach regions of North America, the Ontario district of Canada should not be overlooked. Situated south of the western end of Lake Ontario, climatic conditions are so modified that such yellow-fleshed varieties of peaches as St. John, Fitzgerald, Elberta, and Niagara can be grown successfully in large quantities.

The northern limits of peach-production extend from the southeastern shore of Lake Ontario along the southern shore of Lake Erie and the eastern shore of Lake Michigan as far north as the Grand Traverse on the 44th parallel. This area is often termed the "Great Lakes Belt." Beginning in southwestern and central Massachusetts, another commercial peach area extends across Connecticut, Long Island, the Hudson River Valley, New Jersey, eastern Pennsylvania, Delaware, and Maryland. The Coastal Plain areas in New Jersey, Delaware, and along the eastern shore of Maryland are favorable to peach-production, and the fruit is grown to within a few miles of the seaboard. Farther south, the Coastal Plains area is unfavorable to successful commercial production and the industry is transferred to the Piedmont area across Virginia, North Carolina, and southward to the Gulf districts in Alabama and Texas. Florida has too warm a climate to suit the common standard varieties of peach and has developed a special type from the South China race.

The central or Mississippi Valley district extends from Texas across Oklahoma and Arkansas, Missouri and Kansas to Iowa, Illinois and Indiana, practically connecting with the Great Lakes area. The Pacific Coast Belt includes California, and areas in Nevada, Utah, Colorado, Oregon, and Washington. There are many areas in these so-called "peach belts" that are not favorable to peach-production, but they indicate the general grouping of the industry.

Varieties and types.

All of the common forms of the peach belong to the species *Prunus Persica*, but are sometimes grouped under the name *Amygdalus Persica*. The flat or Peen-to peach is *P. platycarpa*. The United States Department of Agriculture, through its Bureau of Foreign Plant and Seed Introduction, has secured a form of peach from China known as *A. Davidiana* which is used there as a stock for certain cherries. It is said to be very hardy and may prove of value in breeding work, or as a stock for the peach. Its fruit is not attractive enough for use as it is now developed. Several other forms



2785. Honey peach. ($\times \frac{1}{4}$)



2786. Cabler peach. ($\times \frac{1}{4}$)

or types have been collected in China by Frank N. Meyer, of the Department of Agriculture, and sent to the United States for propagation and study. See the article *Prunus*.

The common types of peaches have been grouped into certain races. Onderdonk (Rept. Commr. Agric.,



2787. Crawford peach. ($\times \frac{1}{4}$)

1887) and also Price have placed North American peaches in five groups: (1) The Peen-to or flat peach race, comprising the variety known as Peen-to (Fig. 2784), and also the Angel, and Waldo; (2) the South China race, with oval long-pointed fruit with deep suture near the base, represented by the Honey (Fig. 2785); (3) the Spanish or Indian race, with very late yellow firm often streaked fruit, represented by various southern varieties, as the Cabler (Fig. 2786), Columbia, Galveston, Lulu, Texas, and Victoria; (4) the North China race, with large mostly cling or semi-cling fruit and very large flat leaves, represented by the Greensboro, Waddell, and Carman; (5) the Persian race, including the common varieties of the mid-country and the North, as Crawford (Fig. 2787), Mountain Rose, and the like. The so-called North China and Persian types of peaches are now very much mixed in commercial varieties.

We have been content to say that Elberta (Fig. 2788) is of the North China type, when it is plainly mixed with the Persian, and when studied carefully its characters resemble the Persian type even more than they do the North China. Two types of peach blossoms are commonly recognized (as shown in Fig. 2790), yet there are three distinct types, the large bloom, typical of Greensboro and Waddell and the North China type, the medium bloom of such varieties as Elberta and Belle, and the small bloom of Early and Late Crawford, and others. The botanical significance of these types is not well understood.

A double-flowered peach (Fig. 2789) is sometimes cultivated as an ornamental, as well as a purple-leaved form. A form of the cultivated peach growing wild near Peking, large-flowered, is shown in Fig. 2791.

Propagation.

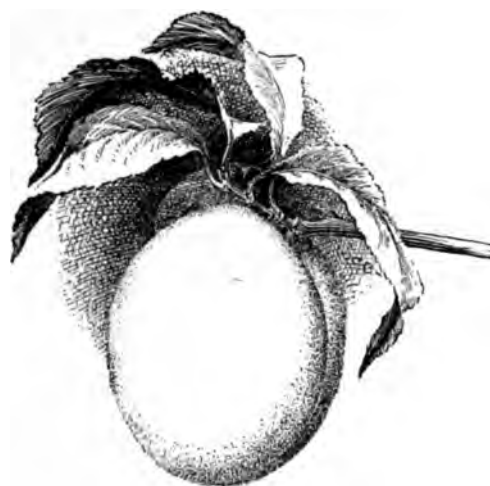
The peach is universally propagated by means of the pits or seeds. A few are sometimes secured by budding upon plum or even cherry stocks, but this dwarfs the tree and makes it susceptible to various stock troubles.

So-called natural seedling pits or seeds gathered in Tennessee and North Carolina are said to be the best for propagation work. Such seeds are considered to be more viable and to produce hardier stock than pits from cultivated varieties. Considerable quantities of so-called "seedling" seeds have undoubtedly been secured from canning factories and represent commercial varieties, although one can readily detect the difference between them. It has not been definitely shown that wild seedling pits will produce a stock that is any more hardy than that which might be secured from the pits of some of our hardier cultivated varie-

ties. Seeds or pits for propagation are treated in two ways. Where severe freezing weather occurs they are commonly planted in the autumn in nursery rows from 4 to 6 feet apart. The pits are scattered a few inches apart in the rows and covered to a depth of about 2 inches. In less severe climates, the pits are stratified very shallow in autumn, are dug up in the spring and the kernels separated from the soil and shells, and planted in nursery rows. By this method, any pit or seed which is not cracked open by the action of the frost may be broken by the use of a hammer. Pits not affected by the frost usually fail to grow the first season, but may do so the second year.

The pits should be planted in good soil and be given careful cultivation so that the seedlings will be at least 24 to 30 inches high by the latter part of August of the first season, and in condition for budding. The buds are inserted the latter part of August or early in September, and simply become united with the seedling stock without making any growth. Early the following spring the seedlings are cut back just above the inserted buds, and all shoots developing from buds of the stock itself are kept rubbed off. In this way the desired bud develops into a vigorous well-branched shoot or tree which should be from 3 to 6 feet high at the close of the season's growth, and is ready for sale that fall or the following spring. So-called "June buds" are secured by budding vigorous seedlings in June and selling the resulting trees in the fall or the spring following. Such trees are smaller and are seldom equal to one-year-old trees except possibly for planting in the South. In Fig. 2792, at the left, is a well-branched one-year-old nursery tree; at the right a slender tree of the same age and height, and in the center a June bud.

The question as to whether trees should be propagated north of the region in which they are grown is a common one. Evidence has shown that it makes little difference as to the latitude in which the trees are raised if they are well grown and are free from injurious



2788. Elberta peach. (\times nearly $\frac{1}{4}$)

insects and diseases. It is generally best, however, to purchase trees as near at hand as good ones may be secured.

The ideal climate for the peach is one in which the winter extremes do not go much lower than zero at any time, and no warm periods of many days' duration occur in winter. The absence of late spring frosts and presence of bright sun during the ripening period are also important essentials. Extremes of either warmth or cold in winter are almost equally detrimental.

Soil.

The peach will succeed upon a wide range of soil-types, but prefers a sandy loam. It will also develop exceptionally well upon gravelly or stony loams, if deep and well drained. Heavy poorly drained soils should be avoided. It also thrives on sands.

Site and elevation.

The type of peach-growing business one expects to engage in has much to do with the kind of location and site that should be chosen.

A successful local market business may be established even upon disconnected areas and at some disadvantage. But extensive peach plantings for supplying the wholesale markets should be planted upon uniformly favorable areas near good shipping-points and where plenty of labor is available. Locations should be sought where peaches can be grown and placed on the market cheaply because of large annual yields and low cost of production and marketing.

The elevation above sea-level at which peaches are planted in any region is a most important matter. It is not sufficient that the orchard be on land that is higher than its immediate surroundings. In some localities an elevation of 150 to 200 feet is sufficient to secure good yields, while in others one must seek altitudes of 800 to 900 feet, or even more, for successful crops. The site of the orchard should also be readily accessible, so that fertilizers, spray materials, and packages can be delivered cheaply and so that the crop may be picked, packed, and shipped economically. Uneven land broken up by gullies or wet areas is to be avoided, as well as hilly areas that are difficult to reach by team and expensive to manage.

The particular exposure is not important in a relatively flat country. In hilly or mountainous sections, it may become so. Severely exposed situations should be avoided, as well as warm pocketed areas. Some protection from severe prevailing winds is most desirable and does not increase the danger of too early blooming if good air-drainage prevails.

Establishing the orchard.

A well-defined plan should be drawn up before planting is begun. The peach is a relatively short-lived tree, and packing-houses and permanent buildings should

be located in connection with roadways and plantings so as to result in the most economical procedure of the work.



2789. Bloom of double-flowered peach. ($\times \frac{1}{2}$)



2790. Bloom of large-flowered and small-flowered peaches. ($\times \frac{1}{2}$)

The selection of varieties must be made previous to the planting of the orchard. Specific recommendations for each district cannot be given in a brief article, but some general statements as to the variety question follow. Yellow-fleshed peaches are preferred by most



2791. Chinese peach, as grown at the Arnold Arboretum, from seeds of wild trees in China. ($\times \frac{3}{8}$) See Garden and Forest, 5: 438.

markets. Such varieties as Mountain Rose, Reeves, Stump, Oldmixon, and the Crawfords are falling behind in popularity except in a few localities. Better varieties are needed commercially. Carman and Belle (of Georgia) are rapidly gaining in commercial importance. New varieties, such as the J. H. Hale, are demanding recognition. Elberta is still the most popular single variety. It is the most widely successful commercial variety of any of our tree-fruits. In making a choice of commercial varieties for any section, a few hardy sorts that are known to do well in the locality are the safest to plant. One should also have enough trees of each variety for economical growing and marketing.

Vigorous one-year-old trees that will caliper $\frac{5}{8}$ to $\frac{3}{4}$ inch and are from 3 to 5 feet in height, as illustrated at the left in Fig. 2792, are an ideal size to plant. They should be free from yellows or little-peach or rosette, root-gall, scale, peach-borers, or other injurious peach enemies.

Fall planting is successful with well-ripened trees in localities in which the winter weather is not severe and where soils are sandy and well drained. In northern districts, fall planting is less likely to be successful. In spring planting, the land should be prepared and the trees set as early as soil conditions permit.

The trees should be set about 20 feet apart each way under average conditions. In some localities 18 feet is sufficient distance, while in others 25 feet is not too much.

Vegetable crops, such as peas, beans, tomatoes, and potatoes, may be grown between the rows of young peach trees for the first and second seasons, after which the practice is of doubtful economy.

Tillage.

The apple is sometimes grown successfully under the sod-mulch system, but attempts to manage the peach in the same way have commonly resulted in failure. The soil of the orchard should be plowed or disced into

a fine mellow condition in the spring as soon as it becomes dry enough to "work" well. This state of tillage should then be maintained until about mid-season by frequent harrowing. The time when culture should cease varies with the locality and the variety.



2792. Different forms of peach trees for planting.

It is seldom possible to cultivate later than ten days or two weeks previous to the ripening of the fruit, as the branches become bent down with the crop. Early varieties should commonly receive one or more cultivations after the crop has been picked. In the South, tillage is often stopped in bearing orchards in late June, while in the North it is continued until late July. In dry seasons, late varieties require additional culture to reach good size. A large proportion of vegetable matter in the soil is an important factor in the production of large fruit, especially in dry seasons. Cover-crops should be grown wherever possible.

Fertilizing.

Rate and character of growth is a great limiting factor in peach-production. A certain amount of growth is necessary to maintain vigor and a proper number of flower-buds. The extent and time of greatest growth determines size, color and quality of fruit to a marked degree. The application of plant-food or fertilizers is a feature of orchard practice that directly concerns rate of growth.

Trees in full bearing should make an annual growth of at least 12 to 18 inches at the tips of leading branches in most peach regions to maintain a maximum production. Fruit-growers should apply fertilizers to secure a growth according to their soil type and its conditions. If such a growth is obtainable without fertilizer, its application may prove detrimental, while if the soil is thin and poor, heavy fertilizing will be required for good results.

Under the average conditions, the equivalent of 100 pounds nitrate of soda, 150 pounds muriate of potash, and 400 pounds acid phosphate will not be found to be excessive, and additional nitrate will be needed in many cases. In districts where the winters are severe, however, nitrogenous fertilizers must be applied sparingly.

Pruning.

Two distinct types of pruning are practised with the peach. One is to allow the tree to form its own particu-

lar habit of development except to thin out the branches somewhat as illustrated in Fig. 2794 as contrasted with Fig. 2793. Figs. 2795 and 2796 show other examples of this treatment. The other is to practise annual cutting back of the branches as well as thinning out, to produce a strong compact and yet well-spread tree, as illustrated in Fig. 2797. The first method may result in the somewhat earlier production of fruit, as much pruning tends to delay fruiting. Trees whose main branches are not cut back annually are more likely to suffer from breakage not only in seasons of heavy crops, but also during ice-storms in winter. On each tree, also, the vigorous fruit-bearing parts tend to extend farther away from the main trunk each year. Fig. 2793 illustrates the habit of growth assumed by an unpruned tree.

The peach produces its fruit-buds upon the one-year-old wood-growth. On vigorous twigs the buds commonly occur in groups of three, as illustrated in Figs. 2798, 2799, the two outer buds being flower-buds and the center bud a leaf-bud. Sometimes all three buds are flower-buds and sometimes only one. Single flower-buds may frequently occur also.

Many fads in pruning prevail, which have no economic bearing upon the amount and quality of the crop. The height to which the trees should be cut back when planted varies with different growers, but from 18 to 24 inches is a good average. Some prefer the extreme of 6 inches, but such low trees often make borer-removal difficult.

At the end of the first season's growth, the real pruning of the tree begins. At that time the main branches of the tree should be chosen. The best three or four well-placed branches should be chosen to form the framework for the future top of the tree as illustrated in Figs. 2800, 2801. These should be distributed upon the trunk and not issue from the same point, although on different sides, as in Fig. 2802. In some cases a tree may have developed only a single irregular shoot and this will then require severe cutting back to encourage branching at the desired height. Fig. 2803 shows a good two-year-old tree, low-headed.

When several side branches occupy much the same space or cross one another, a choice of one should be made and the remainder pruned off. The amount of cutting-back to be practised at the close of the first season upon the main branches selected for the permanent framework of the tree depends on the form of the tree. If it is compact, vigorous, and of the desired form, the cutting back of each tip to the first good side branch is all that is necessary. Should one main branch be irregular in growth, more severe pruning is desirable. Severe cutting-back, save in the case of poorly formed trees, only delays fruiting and increases the expense.

During the second summer, the necessity for severe winter pruning may be prevented by the rubbing off of any shoots that tend to develop as suckers low down upon the trunk, or in the center of the tree where they are not wanted,



2793. Unpruned thick-topped peach tree.

and the pinching back of the tips of any branches that tend to develop in an irregular manner. The removal of shoots should be done before they are more than an inch or two in length. The pinching back of irregular shoots should be accomplished in June or early July before they are more than 18 or 20 inches in length. The removal of much growth and foliage in the summer may cause a severe check to the tree.

The annual dormant-season pruning beginning with the second year should be somewhat as follows: The main branches will develop numerous side branches and the strongest and best placed of these should be retained. A well-formed tree is not only agreeable to look upon, but furthermore the maximum production of good fruit is secured only when the greatest possible amount of vigorous fruit-bearing surface is properly exposed to light. The annual cutting back of the leading branches to the first good side branch will result in well-spread vigorous trees. The cutting of a branch to an "outside bud," however, does not change the direction of growth of that branch to anywhere near the same degree. The cutting back of the branches causes a thickening of the top, and some thinning out of shoots and branches is necessary, otherwise the fruit will lack color.

A central leader is avoided in the pruning of peach trees, and any shoots which tend to shut out the light from the center of the tree should be kept pruned back and not allowed to become more than fruiting twigs. The general form of the tree should be about complete at the close of the third or fourth summer after planting, and the annual pruning will largely consist of the removal of any broken branches and the cutting back of the annual growth on each branch about one-third or one-half, according to the variety and the amount or length of growth. Pruning is often the most economical method of thinning, and this point should not be overlooked.

After peach trees have fruited for several years, they commonly require a severe cutting back to reduce the size of the top and to secure more vigorous wood. Such a cutting back should be practised whenever the fruit-buds are destroyed in winter. All branches may be cut back into wood-growth formed the two or three previous seasons. It is never advisable to saw the main branches back to mere stubs a foot or more in length except upon young trees that are to be top-worked.

Thinning the fruit.

Thinning is now a regular feature of good orchard-management. Small fruit sells for low prices at all times and in seasons of heavy crop-production can hardly be disposed of at any price. When trees are allowed to mature as much fruit as will set in a favorable season, much breakage of branches is the usual result. The small green fruits should be thinned as soon as the so-called "drop" or the natural thinning occurs. Sometimes this fails to take place and then the fruit should be thinned as soon as it is about the size of a shelled hickory-nut. Thinning the



2794. The interior weak branches are removed. (Compare Fig. 2793.)

fruits to not less than 6 inches apart will not reduce the yield of the tree, and 8 inches apart is not too much to secure extra-large fruit, especially upon such sorts as Waddell, Crosby, Mountain Rose, and Stump, which tend to be small to medium in size under average conditions.

Harvesting the fruit.

This part of the peach business really begins as soon as a crop is definitely assured for the season. The



2795. Peach trees allowed to take their natural form.

necessary number of packages should be purchased, the packing-house put in order, and arrangements made for the needed number of teams, trucks, pickers, packers, and other labor.

When the fruit is ready to pick, the work should be organized with one man in constant charge in the orchard. He should direct the pickers and see that each one picks all the fruit that is mature enough at any one time and yet does not take off that which is too green. An efficient picking-crew is necessary in order to secure good results at the packing-house.

White-fleshed peaches change from a light green to a cream-white ground- or under-color as they mature. So-called yellow-fleshed varieties change from a yellowish green to various shades of yellow or orange as they ripen. Pickers should be instructed to determine the maturity of a fruit by its color, and be corrected if they attempt to test it by pressure with the fingers. Good pickers will harvest from sixty to one hundred sixteen-quart baskets a day from well-pruned trees.

The fruit is not uncommonly picked directly into the package in which it is sold, but this practice is rapidly passing in favor of a distinct picking-basket. The most common type in use is a round flat-bottomed wooden stave basket of sixteen quarts capacity.

A low-wheeled wagon is best adapted for hauling the fruit from the orchard to the packing-house.

Packing the fruit for market.

Some sort of a packing-house is necessary when any considerable amount of fruit is handled. A shelter against rain is imperative to prevent the warping of wooden packages. Rapid work in packing can best be organized in a building with a wooden or cement floor and where stencils and tools can be kept in order. A long and relatively narrow packing-house with large doors upon either side is likely to prove the most economical for the handling of the fruit.

Packages, tables, and box- or crate-presses should be arranged in a way to promote rapid and efficient work. No distinct grades of peaches, unfortunately, have become recognized in any broad way. Persons employed as packers should be chosen for their honesty and interest in the business as well as for their rapidity in filling the packages.

The common commercial packages now in use are the sixteen-quart Jersey or Delaware basket and its modifications, the Georgia six-basket carrier, the Michigan bushel and half-bushel, the Climax basket (Fig. 2804) and the western or California box.



2796. The vase-form, or so-called natural-headed tree, in old age.

Packages often arrive on the market in bad condition because they have not been sufficiently well-filled at the orchard. The fruit must be packed tightly enough so that it cannot move in the package during transit.

Simple mechanical graders have been used for some time in some of the peach regions, but have never been entirely satisfactory. The new types of graders are still in the experimental stage. See *Packages*, page 2426, for description of types of fruit-graders.

Markets.

All the large cities in the United States and Canada, in addition to the local towns, consume large quantities of peaches. A grower who is situated near a large local market can allow his fruit to become well-ripened and haul it by wagon or truck without requiring other transportation facilities. Much of the crop must go to market by rail, however, and if in transit more than a few hours, some refrigeration is necessary. Refrigerator cars are employed for this. The large so-called "Fruit-Growers Express" or "Dispatch Cars" will hold five and one-half tons of ice and are capable of carrying 448 Georgia carriers in four tiers, or 558 crates in five tiers.

All crates, boxes, or baskets should be so arranged when placed in refrigerator cars as to allow of a free circulation of air.

Precooling of peaches previous to shipment is practised to some extent, but is not yet common. One who engages in peach-production upon a large scale cannot depend upon local markets to take his entire crop at a profit and must be prepared to ship to the wholesale markets. The ideal shipment is the carload. To ship at least a carload of fruit constantly, one needs to have from about 1,000 to 1,200 trees of each variety in full bearing.

Insects.

The most serious insect enemies of the peach are the borer, San José scale, and curculio. A few years



2797. Headed-in peach tree.

ago the scale was considered the most troublesome of the three, but the borer is now the most difficult to control. The mature insect is wasp-like in appearance, the male shining steel-blue in color with an orange-

yellow band about the abdomen, while the female is of a deeper and duller color. The eggs are laid on the trunk near the ground from June to as late as September, or possibly October. The "grubs" hatch and work their way under the bark and there feed upon the inner bark for about twelve months, when a case is formed of the "sawdust" and other materials, in which the pupa stage is passed. One or two borer larvæ may completely girdle a nursery tree, while several may accomplish similar damage on a young tree in the orchard. In any case the infested tree is greatly weakened. The presence of borers is easily detected by the mass of gum and "chewings" at the base of the tree.

A great variety of materials has been tested as coatings to prevent the entrance of borers, but none has proved to be entirely successful. The expansion of the bark because of growth causes numerous cracks in the coating of most materials that are applied and the borers gain entrance. A soft grade of asphaltum applied to the trunk for a few inches above and below ground is a promising material now under test. Lime-sulfur, white-wash, and other materials may have some value as repellants, but are not very efficient.

The common practice is to remove the soil to a depth of 6 to 8 inches about the trunks of the trees in early spring and to kill the borers by means of a knife and a short piece of wire. Some growers examine their trees in autumn, but there is danger of winter injury unless the soil is put back before severe winter weather occurs.

The San José scale is now easily controlled by a thorough dormant-season spraying of lime-sulfur diluted to a specific gravity of 1.03 to 1.04.

The plum-curculio is a small snout beetle about $\frac{1}{4}$ inch in length with four irregular humps upon the wing-covers. It is dark mottled gray in color with black markings. The principal damage caused by this insect is during seasons of light crops or upon trees just coming into bearing when the loss of a proportion of the green fruits reduces the crop. In seasons of heavy crops, the loss of a proportion of the green fruit may not prove to be of economic importance. The beetle appears in the orchard about blooming time and feeds on the foliage until the calyces are shed from the fruits, when egg-laying begins. If the egg hatches, the larva makes its way to the center of the peach and feeds upon the developing germ, causing the fruit to fall from the tree later. The mature beetle may also do considerable feeding upon the outside of the peach while it is still small, causing irregular blemishes that may markedly effect the commercial value of the fruit. The curculio is most troublesome when the orchard is surrounded by grasslands and hedgerows of weeds and native trees. When much of the area is under cultivation and good orchard practice prevails, the damage is greatly reduced. A spraying of arsenate of lead just after the petals fall, and again just as the calyces are shedding from the fruits, will destroy many of the curculio. It is best to combine the lead with the self-boiled lime-sulfur to secure a better distribution of the lead and prevent any burning of foliage by an inferior product.

The bark-beetle is a small black insect not more than $\frac{1}{8}$ inch in length that attacks the bark upon weakened trees, causing gum to exude in spots upon the trunk and branches. Fortunately, the insect usually causes little or no damage to vigorous healthy trees and its presence indicates that some other factor is really to blame, although it is sometimes reported on healthy trees. The black peach aphid is occasionally troublesome upon light soils, but good culture and a vigorous



2798. Fruit-buds of the peach with leaf-bud between.

growth commonly prevents any serious check to the trees.

Various beetles and grasshoppers may cause some damage at times by feeding upon the peach, such injuries being most common in orchards in which grass or weeds are allowed to grow freely.

Diseases.

The peach is subject to the attacks of a considerable number of diseases. The most difficult to combat are yellows, little-peach, and rosette. The causes of these diseases are still unknown. Some suggest the presence of a fungus, others an organism too small to be detected by the ordinary microscope, and there is also the possibility of enzymes.

The advanced stages of yellows are indicated by a premature of the fruit from a few days to at least two weeks in advance of the normal season. Such fruit is commonly red-spotted and blotched in its coloring and may be insipid or bitter in flavor. Affected trees may also develop sickly wiry twig-growths on the trunks and branches.

Little-peach is indicated by a characteristic drooping of the foliage and by the fact that the fruit is smaller and matures later than the fruit on healthy trees.

Rosette occurs only in southern districts and is readily distinguished by the tufts of leaf-development. This disease is fatal within twelve months in many instances.

It is not known whether these diseases are entirely distinct or not, but they have been so regarded. Yellows and little-peach attack all varieties in about the same proportion. Infection does not appear to take place through the soil, flowers, or seed. These diseases can readily be transmitted to healthy trees or stocks, however, by budding. Buds taken from the apparently healthy parts of diseased trees have invariably reproduced the diseases.

The recognition of early stages of yellows and little-peach have shown that these diseases are too frequently distributed in nursery stock. It is now known that a tree may be infected with either of these diseases for three or four years without showing any prominent symptoms. When good growing conditions are provided, the true state of affairs may be masked for a time, but a check to growth will result in the prompt appearance of the advanced stages of disease.

Many cases of so-called "cures" of yellows have been announced, but all have been without sound basis. Too often trees affected with borers, winter injury and other troubles are considered to be affected with yellows. Diseased trees should be destroyed as soon as detected. When such trees are left in an orchard, the disease spreads to surrounding trees until all are affected. If all diseased trees were destroyed annually in any district and no diseased nursery trees were introduced, the annual loss could readily be kept as low as 1 per cent, without much doubt. Yellows attacks Japanese plums as well as peaches, and this should not be overlooked in control work.

Peach leaf-curl, brown-rot, peach-scab and mildew are fungous diseases of the peach which cause much damage annually. The leaf-curl attacks the foliage in early spring just as the leaf-buds open, and the leaves become curled, thickened, and distorted. The tips of shoots may also become affected and the disease is occasionally seen upon the fruit in a fan-shaped discolored area. The affected leaves finally turn brown, and fall from the trees in early summer. In severe attacks, the trees are almost completely defoliated, greatly reducing their vigor and causing them to lose most of the fruit which may have set. This disease is readily controlled by a spraying with lime-sulfur, as directed for the scale, before the leaf-buds begin to make growth. After the leaf-buds begin to expand, however, the spraying may not prove effective. Recent experiments have been tried with apparent success in

New York of fall spraying for leaf-curl, as late as the first part of December.

Brown-rot was formerly one of the dreads of the peach-grower. Thousands of baskets of fruit frequently rotted on the trees just at harvest time. Not until the value and safety of self-boiled lime-sulfur summer spray was demonstrated by Scott were the peach-growers supplied with an effective remedy for the disease. This affliction may not only cause a rapid decay of the fruit at ripening time, but it sometimes attacks the blossoms and causes their death. The affected blooms are distinguished from frost injuries from the fact that they cling to the twigs, and gum commonly oozes out from the canker formed upon the twig at the base of the bloom. The small green fruits may also decay at all stages, and the twigs may be killed outright from numerous cankers upon the bark. Such varieties as Triumph and Connecticut frequently begin to rot before they ripen, and the entire crop may be lost even when well sprayed. Such sorts should never be planted. Varieties as susceptible as Champion are not very satisfactory shipping varieties. A thorough system of summer spraying, as outlined under "spraying" (page 2500), should control brown-rot.

Peach-scab is a fungous disease which appears upon the fruits in the form of small black dots. In severe cases these dots may be so numerous as to form a sooty blotch. The skin of the fruit may then crack, offering an excellent opportunity for brown-rot to begin its destruction. Peach-scab is most serious from central New Jersey south to Georgia. Upon hilly areas, north of central New Jersey, it is rather uncommon



2799. The three leaves at a joint, where fruit-buds are forming. Fruit-buds sometimes form in the axil of single leaves, and sometimes on short spurs.

and it seldom requires any attention. The disease occurs only upon the upper surface and ends of the peach as it grows on the branch. It makes its appearance in the form of very minute black spots or dots from about the middle to the last of June upon early varieties in New Jersey, Delaware and Maryland. Farther south it occurs correspondingly earlier. It may be readily controlled by thorough summer spraying with the self-boiled lime-sulfur.

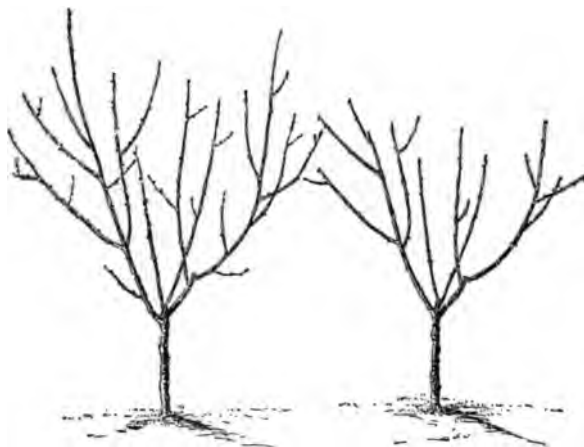
Peach-mildew most frequently occurs along the northern limits of peach-production near the Great Lakes, and in the Northwest. This is probably because of the wider extremes of temperature during the day.

Mildew appears in the form of a white powdery substance upon the leaves and fruit. It may do considerable damage to nursery stock in some cases. Spraying

with self-boiled lime-sulfur will commonly hold it in check.

Spraying.

The peach is subject to the attacks of numerous disease and insect enemies, and thorough spraying is required for success in most cases. The peach foliage is very sensitive to caustic sprays, however, and



2800. Young peach trees pruned, one of them headed back.

great damage may be done from ignorance. Copper sprays, such as bordeaux, are dangerous to use on peach foliage in humid climates. San José scale and leaf-curl can be controlled by a winter spraying of lime-sulfur. Peach-scab and brown-rot can be held in check by several sprayings of the self-boiled lime-sulfur summer spray.

When San José scale, leaf-curl, peach-scab, brown-rot and curculio appear to any considerable extent, the following spraying schedule is suggested:

1. For scale and leaf-curl, apply concentrated lime-sulfur diluted to a specific gravity of 1.03 to 1.04 before the leaf-buds start to make growth in early spring.
2. Just after the petals fall, apply self-boiled lime-sulfur of an 8-8-50 formula and arsenate of lead at the rate of three pounds of paste, or one and one-half pounds of powdered lead to each fifty gallons of spray.
3. Repeat this when the calyces are shedding from the fruits or when the latter are about the size of green peas.
4. Apply self-boiled lime-sulfur without the addition of arsenate of lead three weeks after the third spraying.
5. Apply self-boiled lime-sulfur again three weeks later to all varieties ripening later than Carman.
6. In wet seasons and especially for varieties as late as Fox, Salway, or Bilyeu, an additional spraying may prove profitable.

No spraying should be done within less than three weeks of the ripe stage, or the fruit may have a white-washed appearance.

Where the plum-curculio causes little or no damage, the second spraying may be omitted, and where peach-scab and brown-rot are uncommon, the fourth, fifth, and sixth sprayings may be omitted.

Winter injuries.

There are several forms of winter injury, including bud-killing, twig-killing, collar injury and bark-splitting. Bud-killing takes place when the temperature is too severe in winter. The pistils and stamens are killed in their rudimentary state, giving the center of the bud a brown or black appearance when a cross-section is made. Poorly formed buds often die even

when the winter temperatures are not particularly severe. Alternate warm and cold periods may also result in bud-killing. Varieties such as Reeves, Early Crawford, and Mountain Rose suffer more from bud-killing than Greensboro, Carman, or Crosby. Vigorous trees that ripen their wood-growth early are best able to withstand low temperatures successfully. Trees that make a relatively late growth are, however, more successful in resisting the effects of a variable winter.

Twig-killing is a more severe form of injury than bud-killing, and following such injury the trees should be well cut back before growth begins.

Collar injury is caused by the action of the weather upon the bark of the trunk just at or below the surface of the ground. In mild cases, the inner bark becomes yellow in color and very spongy. The tree is checked in growth and the fruit forced to an unusually large size. The lenticels or dots are large and the flavor of the fruit is often astringent, due to a large proportion of tannin. In more severe cases of injury, the trees suddenly die in midsummer with the shriveled fruit clinging to the twigs. Bark-beetles often attack trees checked by winter injury and the death of the trees is often entirely attributed to their attacks. The Elberta appears to be more susceptible to this form of winter injury than such varieties as Greensboro or Carman. The soil should be firmly mounded up for about a foot against the trunks of peach trees just before freezing weather each fall to prevent such winter injury.

The bark on the trunks of old peach trees may occasionally crack open as a result of winter weather. The most that can be done is to cut away the bark that has separated from the sap-wood and to paint the latter to prevent decay.

Peach trees not infrequently suffer injury to the sap-wood of the branches and twigs, and the trees may fail to grow vigorously the following spring. Such trees should be given liberal fertilizing and be kept well cultivated to promote a good growth. M. A. BLAKE.

Peach-culture in the South.

Peaches have been abundant in the southern states since the very earliest settlement, the so-called Spanish varieties being first distributed by the early settlers in Florida, and to this day, all through the South Atlantic States, the old "Spanish Blood" or "Tinsley" peach, is spoken of as one of the choice fruits of the earth. From time to time all the improved varieties were scattered through the South by the more progressive horticulturists and nurserymen and these and their seedlings were abundant on nearly every plantation. The South being strictly an agricultural country, there was little chance for commercial peach-culture until along between 1870 and 1875, when the introduction of a number of new extra-early varieties of the Alexander type, seedlings of Hale and Rivers, gave such bright showy peaches the latter part of May and early June that attempts were made to market them at a profit in our northern cities.

A lack of quick through railway-express service caused them to be three and four days on the way, and usually to be delivered in poor condition. Occasional lots, arriving in fair to good condition and selling at \$12 to \$20 a bushel, convinced a few of the shippers that the extra-early peaches of the South were appreciated at the North, and persistent efforts were continued to get them to market in sound condition. Every conceivable style of shipping package was used,—paper-wrapped fruit placed between layers of cotton, excelsior, paper, and the like, and sent by express or steamer,—and all brought about the same returns, "Arrived in bad order." Only occasional lots paid a profit. Finally, heavy refrigerator boxes that would hold about six bushels of fruit in packages, and a sufficient quantity of ice, with strong castor wheels under them so they could

be trundled in and out of freight cars, were utilized to bring peaches north by Savannah and Charleston steamers; and by re-icing on the steamers, much of the early fruit came through in good order and sold at such satisfactory prices as to encourage the sending of the large midsummer peaches to market in the same way, and the planting of moderate-sized orchards and the further experimenting with seedlings and varieties best suited to long shipments.

The perfection of the refrigerator car for fruit transportation, improved machinery for the cheap manufacture of ice, the consolidation of various small railway lines into great through routes of transportation, and a full appreciation by their managers of the importance of a successful peach industry, and last but not least, the originating of the Elberta peach by Mr. Rumph, were the final factors in rapidly developing the great commercial peach industry in Georgia, and its smaller counterparts in South Carolina, Alabama, Mississippi, and the more recent rush of overplanting in Texas, Arkansas, Oklahoma, and southern Missouri.

The year 1889 saw the first large peach crop successfully harvested and marketed. Profits were large, and being reported in the press many times greater than they really were, stimulated much planting by those entirely unfamiliar with fruit-culture, and with no special love for it except the money that might be made out of it. Cheap lands and the abundance of good low-priced labor were encouragements to extensive plantings. In nearly every state of the South, land in vast tracts suitable for peach-culture could be had at \$3 to \$10 an acre, and labor from sun to sun at 40 to 60 cents a day; while in 1915 these lands are selling at \$25 to \$100 an acre, with a possible average of \$40, and labor costs \$1 a day or more, while the added expense of three or more sprayings each year has helped to double the cost of peach-production in the South.

Along the Atlantic and Gulf coasts, varying from 100 to 200 miles inland, most of the land being low and flat, early blooming, followed by spring frost, makes the peach industry too uncertain to be profitable. The hill lands in western sections of Atlantic Coast states, and northern sections of the Gulf States, is really the peach country of the South, where extended lists of varieties are grown, covering a season of fully two months; while the southwestern states, planting almost entirely of one variety, have a season of less than two weeks in many orchards. Fort Valley and Marshallville, the great peach centers of Georgia, though on tablelands about 200 miles from both ocean and Gulf, and at an elevation of a little over 500 feet, are not in what might strictly be called the hill country, being just below the southern edge of it. In this section of Georgia, most of the peach orchards have been planted on old cottonland, much of which has been in cultivation a century or more, and while the surface-soil is worn and poor, down deep in the red clay soil underlying the 6 or 8 inches of sandy gray loam of the surface, there must be a vast amount of fertility from the way peach trees grow when once started and a reasonable amount of culture is given.

In the early days most of the orchardists, who were cotton-planters as well, planted second- and third-class yearling trees, or else small June-budded trees any time from October to March, opening furrows for the trees and cross-checking the rows 18 to 22 feet apart, later plowing this land and planting it in cotton, continuing it for three and often four years. Two to four hundred pounds of low-grade fertilizer is applied in drills for the cotton and usually very thorough culture given; trees are allowed to grow at will, their culture being incidental to the cotton crop. In such orchards very little if any pruning was ever attempted. After the trees become so large as to drive out the cotton, one plowing is given in winter, then anything from fairly good culture to none at all the remainder

of each season. Such a system resulted in many "scrub orchards," that were not very profitable after six or seven years.

In the recent and more highly developed peach orcharding of this section of the South, better preparation is given the land at the start, dynamiting of the holes for planting being largely practised. There is a more careful selection of trees, far more liberal fertilizing, planting at greater distances, seldom less than 20 by 20 feet, better culture, less and less of intercropping, except of cowpeas and other cover-crops, and somewhat more of systematic pruning, though as yet this art is not fully enough practised to show best results. Many of the land-booming orchards, planted between 1890 and 1900, proved financial failures and are either no longer in existence or else have been absorbed into other and better propositions. There are less and less of the cotton farmer orchardists and more peach specialists, as time and experience have shown the business to be unprofitable, except under best business conditions. The writer's plantations, which ten years ago aggregated some 265,000 trees, have now been reduced to less than 100,000 trees, as only by planting at greater distances and giving a less number of trees better care and attention, can any profit be assured.

All land is plowed deep, and sometimes subsoiled before planting. Young orchards are given frequent and thorough tillage up to midseason, when two or three rows of cowpeas are drilled in at least 4 feet away from the rows of trees; these and the trees are cultivated frequently, until the peas have taken almost full possession of the ground, and it is time for both the land and trees to have a rest from cultivation. In the fall when peas are ripe, enough are gathered for next year's seed, after which hogs or mules may be turned in to pasture for a time. The stubble furnishes a fine winter cover, and is turned down at first plowing in February or March, when summer culture begins, and at proper time the orchard is again seeded to cowpeas, across the former direction of the rows. Three years of this usually builds up a perfect orchard without the aid of any other fertilizers, except possibly a very little about the trees at time of planting to give them a start.

Low-headed trees are the rule, the trunks seldom branching over 18 inches up, and often 8 inches to



2801. Before and after pruning.

a foot from the ground. As a rule, the close cutting-back at time of planting, and a general shortening-in of the leading branches for the first two or three years, is about all the pruning given, even in the best orchards. A good plan is to shorten-in every year much of the past season's growth, and from the central head often cut back two or three seasons' growth; but under no circumstances are any of the good side shoots cut out

that force themselves on all the main stems when the top is properly headed back. These little side branches have given several full crops of fruit, when without them there has been failure.

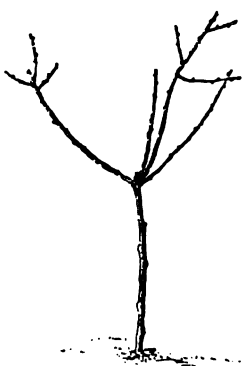
Soil and climate favor the very brightest of color on all peaches in the South; qualities of the soil and the long, hot summer sun give a richness and sweetness of flavor superior to any other section of America, though the same varieties are not so juicy or luscious as when grown farther North.

The orchards in connection with cotton plantations run all the way from 10 to 100 acres in extent, while the "straight-out peach farm" seldom has as few as 50 acres in fruit, more of them having from 100 to 200 acres, while orchards all the way from 300 to nearly 1,000 acres in extent are no uncommon sight. The Georgia peach industry turns out 5,000 to 7,000 carloads of peaches in seven or eight weeks of a busy picking season, even though the 18,000,000 trees estimated to have been in that state ten years ago have now been reduced to less than 8,000,000.

Growth usually ceases early in August, and the trees shed their leaves the last of September, a month or six weeks before any frosts occur. Should the fall be warm and wet, some fruit-buds will be forced into bloom, while the greater number will remain dormant until late January or early February, when spring growth commences. The season of full bloom is usually about the first week in March, though it varies all the way from February 15 to March 25, and no matter whether early or late, the entire blooming season of most varieties covers a period of nearly three weeks. While spring frosts are the greatest menace to southern peach-culture, this long blooming period often gives a chance for a setting of fruit between the various frosts, or after the last one, from some belated buds. Even with these varying chances of escaping between frosts, about one year in three frost destroys the peach crop in some one or more of the great centers of peach-production in the South.

Two other serious troubles hamper the southern peach cultivator—curculio and monilia or brown-rot. Curculios are very abundant; beginning early in April, they keep up their destructive work until the end of the fruiting season. In recent years in the summer spraying for monilia, the addition of arsenate of lead has controlled the ravages of curculio so well that now they are far less destructive than before. The early spring months at the South are inclined to be pleasant

and very dry, and the summer rains, which are frequent and abundant when they do come, often do not set in until the latter part of July or early August, near the end of the peach-shipping season. Often, however, they begin in June, and continue for two or three weeks, and in the case of the season of 1900 it rained for six weeks through the main part of the peach harvest. Hot sun between showers and the general mugginess of a warm climate rapidly breed the monilia fungus, and brown-rot is the most serious trouble the southern peach-grower has



2802. A bad form of top.

to contend with, though with proper spraying it may be held almost entirely in check, and except for the extra expense is not now to be feared as in the earlier days of southern peach-culture. In the ten years from 1895 to 1905, probably more than 50 per cent of peaches grown in Georgia rotted on the trees, or else

reached market in specky condition as the results of monilia fungus.

The first great crop of Georgia peaches that made a strong impress on all northern markets was in 1889, when the Elberta variety by its large size, great beauty, and fine keeping qualities showed up so strongly for the first time as to outclass all other varieties. Great profits were made and, being reported as even greater, there was a mad rush to plant Elberta, and Elberta only. This was kept up until 1896-7 before it came to be realized that there could be too much of even a good thing. The rushing of a great volume of fruit, no matter how choice, into the markets in two or three weeks, before they had been "toned up" to at least a liberal supply of good fruit, was a business mistake. To remedy this there has been a hunt after a good early variety to precede the Elberta, as well as later ones to follow it. So that, while prior to 1896 more than 75 per cent of the plantings were of Elberta, since that time not more than 15 to 20 per cent of Elberta have been planted. There is a better balance of varieties, and a longer and more profitable season of marketing has been assured. Many early and mid-early varieties growing ten or fifteen years ago have mostly been abandoned, Greensboro, Carman, Hiley and Belle (of Georgia) being varieties most largely grown to precede Elberta. Growers are now beginning to abandon the Greensboro and plant excessively of other extra-early varieties, notably Uneda, Arp (Arp Beauty or Queen of Dixie), and Early Rose. These varieties having sold at extremely high prices in recent years, there now appears as great a tendency to plant extra-early ripening peaches as there was for the Elberta in the earlier days.

When loading in cars, the crates are placed side by side about 2½ inches apart across the car, taking seven crates. Then two strips of inch-square stuff, just long enough to reach across the car, are put on top of the crates at each end and are lightly nailed down. Tier upon tier is built up in this way, either five or six crates high, until the car is full. Spacing of the crates and the slatting provides space for cold air around each and every crate. In dry seasons, when fruit is free from rotgerms, cars as now constructed can with safety be loaded five crates high, but in wet seasons, with rot prevalent, they arrive in market in much better condition when loaded only four high. Besides the original icing, which requires four to six tons to a car, a re-icing after loading takes one to three tons, depending upon how long the car is loading. A car will hold 448 to 525 crates, according to the size of the car and whether loaded four or five crates high. Handled along best modern lines, with careful inspection from start to finish, it costs for the six-basket Georgia carrier, from 30 to 35 cents to take peaches ripe from the tree and place them in the car.

Some peaches of the Crawford type are grown all through the South, but they do not succeed so well as most others of the Persian strain, and none of the Persians does so well in the far South as the North China strains, to which Carman, Hiley, Early Rose, Belle, and Elberta belong. The South China peaches, to which the Peen-to, Honey, and Angel belong, succeed best in Florida and close along the Gulf Coast. While their bitter-sweet flavor is appreciated by some, they are not generally profitable for market.

In preparation for marketing the fruit crop, many of the large orchards have railroad side-tracks running to their packing-houses in the orchard; refrigerator cars are brought South, and every available bit of side-track for 300 or 400 miles about is filled with these cars. At leading centers, refrigerator-car people have constructed great ice-storage-houses, with every convenience for quickly icing and re-icing cars. Agents of these refrigerator-car companies, by frequently driving about among the orchards and keeping in touch with the managers, plan to have enough cars iced and

cooled off so as to be ready for each day's demand, and by placing an order with the railroad agent the night before, the orchardist may have one or a dozen refrigerator cars delivered on his side-track in the morning. For smaller shippers, who cannot load in carlots, the railroads keep at all times in season refrigerator cars on siding at each station in the peach district, into which any number of shippers may load; more often there will be a number of such cars loading at the same time, so that a shipper may have a choice as to which market he will consign his fruit. Except in the height of the season, these cars are often two and sometimes three days in loading, and the continued opening of the car to put in small lots of fruit prevents perfect refrigeration; consequently fruit from small shippers more often goes to market in bad order than from the larger orchards, where a car can be quickly loaded and at once closed up, not to be opened until ready for sale in some northern market. In the Hale orchards, a car is often loaded in an hour, and very little of the fruit is ever so long as two hours passing from the tree through the assorting- and packing-houses to the car.

In some of the smaller orchards, fruit is packed in crates or baskets under the trees, and then hauled in open wagons, often without springs, to the railroad station. In others, some of the old farm buildings are used as packing-houses; more often special fruit-houses are used, their size depending upon the requirements of the orchards, while in style and convenience more depends upon the intelligence of the orchardists and desire to handle the fruit rapidly in best possible manner. The picking-basket most generally used is a shallow, round basket, with a drop handle, and holding about a half-bushel. With good refrigerator cars and prompt railroad service, fruit is now allowed to come to full maturity on the tree, and is picked just before it begins to soften.

Since the organization of the Georgia Fruit Exchange, some eight or ten years ago, about 75 per cent of the peach-growers of Georgia, Alabama, and South Carolina have, through this coöperation, been enabled to secure a wider distribution and a more uniform market-price for their products, and their business is on a more secure foundation than in any other section of the South.

J. H. HALE.

Peach-growing in California.

The peach is a fruit of wide commercial importance in California. The great peach-growing sections are principally in the San Joaquin and Sacramento valleys, but orchards are found and are profitable not only in the mountains up to an altitude of 3,000 feet, but also in the coast sections. The most important districts are the first named. For size, flavor, color, and shipping qualities, the peaches grown in this state have a national reputation.

The tree thrives not only on the sandy, loamy soils which are adapted to irrigation and are well drained, but also on the heavier red and black soils, which are more or less mixed with gravel and are found both in the foothill and coast regions of California. On account of the arid climate, there being no rainfall from May until October, it goes without saying that to produce high-class peaches for either shipping, canning, or drying, irrigation is very essential. The theory that was formerly advanced that irrigated fruit would not keep, has not been borne out in practice, and to attempt to grow peaches without irrigation, particularly in the great valleys, would now be considered the height of folly.

No systematic plan has been followed in fertilizing orchards, although growers are realizing that to grow good fruit and to maintain an orchard up to the very highest standard, the application of fertilizers is essential. Considerable interest is now taken in cover-crops,

and a number of experiments have been made with Canada field peas, fenugreek, and vetch. To grow a cover-crop successfully, it is necessary to have water in the fall, and as water from the canals is not obtainable, it must be secured by pumping. Barnyard manure, when it is to be had, is given the preference by growers. This is becoming very scarce, however, and eventually commercial fertilizers will come into general use.



2803. A good two-year-old peach tree.

Peach trees are transplanted in California when they are one year old from the bud, except in years when stock is scarce and trees sell at high prices, when many growers purchase June buds, which transplant readily, providing care is taken to allow them to mature fully in the nursery before digging.

Nothing will bring a peach tree to a premature end more quickly than not to prune. Trees when transplanted to the orchard should be pruned both root and top. The root-pruning should be the shortening-in of all the roots at least one-third and the removal of all bruised and lacerated roots.

After the trees are set, they should have the top cut off to within 20 inches of the ground, even if the tree be 6 feet or more in height. In most cases, the failure of trees to grow may be attributed to the orchardist's failure to observe this simple rule. It is very necessary to settle the soil around the tree, either by irrigating (running the water in furrows), or by tanking (using not less than fifteen gallons of water to a tree).

The winter following the planting in the orchard, the branches forming the head should be confined to not more than five at the very outside, and four is better. These should be cut back at least two-thirds and all laterals removed.

This pruning will not only cause the trees to grow stocky, but it will probably also serve the purpose of making the framework branches very sturdy. The tree will respond by making an immense growth and in the second winter the shortening-in of this growth will again have to be very severe, and thinning will have to be practised. The point to be considered in this case again is to give the tree not only the goblet form, but to perfect it, for this pruning increases its vigor

and makes it capable of producing heavy crops which are well protected from any injury by the sun, due to its wealth of foliage. From the third year, two or three laterals are allowed to grow on each of the frameworks, and their growth is again shortened-in severely. In the fourth year, the pruning need not be so severe, and a reasonable crop of fruit may be expected. Pruning in after years should be followed out regularly each season if good crops are to be secured and the longevity of the tree maintained.

It is a mistake to plant peach trees too close together. In former years it was customary to plant 20 by 20 feet, but now trees are planted 24 by 24 feet, as better results have been secured at this distance.

Thinning must be practised when the crop is heavy, for, if not followed carefully, the fruit will lack size, and no matter for what purpose it is used it will go into an inferior grade and at prices which would be very unsatisfactory to the grower. The peaches should never be closer than 4 inches apart. If the ground underneath the tree has the appearance of being covered with a green carpet from the effect of the thinning, it is evidence that the work has been well done.

When shipped fresh, peaches are wrapped in soft paper and packed in twenty-pound boxes. The number



2804. Peach-packing. The Climax basket.

of peaches shipped out of California is about 2,200 carloads annually. For local consumption in the larger cities, the peaches are shipped in open lug boxes, holding about forty pounds.

The free-stone peaches are the only ones dried, as a rule. These are first halved, the pits are removed, and the fruit is placed in trays. The drying takes place in the sun altogether. Before drying, the peaches are exposed to the fumes of sulfur for not less than four hours. This not only kills any insect life but gives the peaches a much more appetizing appearance. The very heavy tonnage of dried peaches, averaging 30,000 tons annually, would be utterly impossible to handle unless the same could be dried by exposure to the sun's rays. It requires from six to seven pounds of fresh peaches to make one pound of the dried product. Many persons object to the fuzzy skins on the dried fruit and in recent years peeled peaches have been in the markets in a limited way. The method of peeling has been to expose the halved peaches to the sulfur fumes for several hours. This loosens the skins and they peel off readily. This handling of the fruit is expensive, however, and with the difficulty of securing labor, it has not been practicable except on a small scale. This method has been very much improved, however, and the peaches after being halved are now dipped in a hot lye bath for fifty seconds, using about one pound to ten gallons of water. The peaches are then given a bath in cold water, not only to remove

every vestige of lye, but to cause the skins to slough off. Peaches treated in this way sell at twice the price of the unpeeled peaches and the entire character of the fruit is changed. Outside of the lye bath, which is the only additional treatment the fruit receives, the process is the same as is followed when the peaches are not peeled.

The canning of peaches is another important branch of the industry, the output from California being in the neighborhood of 84,000 tons annually. This work is conducted exclusively by commercial concerns having every modern appliance to handle the fruit expeditiously and turn out uniform grades. Outside of the halving of the peaches, which work is done by women, the work is accomplished entirely with machinery. Sanitary cans are used as containers and a limited quantity of the fruit is placed in glass jars. The commercializing of the industry has created a demand for well-defined standards. To illustrate this, the only peaches which are regarded as the leaders by the canning trade are the clings; and in the list of varieties, the Tuskena, Orange, and Phillips, all of which are yellow, are in the heaviest demand. Peaches that have no red at the pit are preferred for canning, as the syrup never becomes discolored. The important place which the canning industry occupies in the peach business will be sure to bring about improvements in varieties to meet the demand for peaches with smaller pits, finer-grained and more highly flavored flesh. Already several new varieties, mostly chance seedlings, have been introduced and are attracting considerable attention. For shipping, Alexander, Briggs (Red May), Early Hale, Dewey, Imperial, Sneed, Elberta, and Salway are recognized as standards; for drying, Elberta, Foster, Late Crawford, Lovell, Muir, Susquehanna, and Wheatland; for canning, Tuscan, Runyon, and Sella (Orange) Clings, McDevitt and Phillip and Levy (or Henrietta).

Fortunately, the California peach orchards have never been threatened with insect pests or diseases that cannot be controlled. The crown root-borer is troublesome, in some sections, but it has always been under control. The San José scale is no longer regarded as a very serious pest, for it is held in check by predaceous insects and by spraying with lime-sulfur washes. Leaf-curl in some years gives considerable trouble, but if the trees are given a thorough spraying with bordeaux, it is easily controlled.

The average life of a peach orchard is twenty years, but there are many profitable orchards much older than this, when they have received good care.

A failure of a peach crop has never been known in California, and although in some years the crop has been curtailed by late spring frosts, growers have never practised smudging to any extent.

GEORGE C. ROEDING.

Protecting peach trees in cold climates.

Numerous ways of protecting peach trees from the effects of trying winter weather have been devised. Such plans include the placing of a protective covering about the trunk and branches of the tree. Cornstalks, straw, hay, evergreen boughs, and similar materials may be used for this purpose. Some persons have tried the plan of laying the tree on the ground in an effort to make the work of covering easier as well as more effective.

Peach trees may be laid on one side with comparative ease and without much injury, providing the process is begun when the trees are small. The root-system is manipulated at this time in such a way that most of it extends in two opposite directions. This is accomplished by cutting the roots, beginning when the trees are small, preferably the first winter after planting and thus accustoming them to the operation from the beginning. If this plan is followed from the start, a

little work with the spade will suffice to lay a tree down. Once on its side, the branches should be gathered together with twine and the covering put in place and weighted down.

An interesting method of laying a tree down without disturbing its roots was devised a number of years ago. This is accomplished by bending the newly planted tree over to the ground, where it is fastened. The side branches are cut off at first as fast as they appear, thus inducing a long straight growth. After the prostrate stem has attained a length of 10 to 12 feet, an upright top is allowed to develop. At the approach of winter, the top of a tree trained in this manner can be pushed over easily, as the long prostrate trunk serves as a lever or pivot. The long exposed trunk will need to be protected at all times from the effects of the sun. This is easiest done by using an inverted trough made of light boards.

The process of laying trees down under irrigated conditions is somewhat simplified, as the ground can be made very soft by the use of water. Here, again, the work should be begun the first winter after planting. The ground about the young tree is first saturated with water from the irrigation ditch. The trees are then pushed over in the direction that offers the least resistance. After the branches have been drawn together with cord, they are covered first with burlap, then with a light coating of earth. As the trees become more mature, a basin about 4 feet in diameter is made in the earth about the trunks before the water is turned in.

The nicest of judgment must be used in removing the covering in the spring, as a little too much warmth or a slight exposure to cold may mean the loss of the year's work. At the first sign of swelling buds in the spring, the earth covering must be lightened during the middle of the day and replaced for the night. As growing weather comes on, still more of the covering is removed and a certain amount put back each night until the tree is raised for the summer. The danger of damage by cold continues until the fruits have attained considerable size, consequently the work of uncovering in the middle of the day and of covering for the night extends through a comparatively long period.

After the danger of damage by frost is passed, the ground is again irrigated and the trees are raised. Trees so handled are unable to support themselves in an upright position, consequently they are supported at an angle by props. It is estimated that the entire labor of laying a tree down, covering and of raising again in the spring, can be done at a cost of 50 cents a tree.

W. PADDOCK.

PEANUT (*Arachis hypogaea*). Popularly the peanut, as the name indicates, is called a nut, but it more properly falls into the class of grain or forage crops. The fruit or "nut" is really a pod, comparable with a bean-pod or pea-pod. The plant is related to beans and peas. The seeds (comparable with bean seeds) furnish excellent food for man as well as for his beasts and fowls, and the cured tops make an excellent hay or forage. The peanut is usually not classed with horticultural crops; for a fuller account, see Vol. II, "Cyclopedia of American Agriculture."

Commercially, the peanut is not grown north of the latitude of Washington, D. C., but on the sandy and loamy soils to the south and west of the above-named city, on lands that have recently been limed, it may be used as a rotation or as a special money crop. North of this territory the plant can be used with profit as a forage for hogs, although only a portion of the pods set will come to maturity. As a garden plant, the peanut can be grown as far north as central New York, but only a few pods will actually mature seeds, except in long warm growing seasons.

There are two general types of peanuts: those known as bunch nuts, and as vine or trailing nuts. The bunch

nuts are most desirable because the tops can be more easily harvested for forage, the rows may be closer together and the distance between the plants in the row may be less than with the vining types. The cultivation as well as the harvesting (digging) is easier. The bunch type of nuts, such as the Spanish and Valencia, may be planted in rows 30 to 36 inches apart, with the seeds scattered 6 to 10 inches apart along the row. The large-seeded thick-shelled nuts require to be shelled before planting in order to insure satisfactory germination, but the smaller thin-shelled sorts may be planted whole and a good stand secured. The planting season, as well as the field care of peanuts, is practically the same as for corn. They are tender to frost and grow best during warm weather. The vines will be killed by the first frosts, but when desired for forage should be harvested in advance of that date. As the pods or nuts are borne beneath the surface of the soil, the crop is harvested by lifting or plowing out the whole plant, separating it from the earth and curing the plant and pods together by stacking them in tall narrow stacks built up around a slender stake about 6 feet high, at the bottom of which cleats 3 feet long have been nailed in such a way as to keep the plants off the ground. The stacks are so built as to cause the vines to protect the nuts. The roots with the nuts attached are placed next to the stake, with the tops out. This method permits the nuts to be cured slowly and without discoloration or staining that would result were the nuts exposed to the weather. The plant is a most interesting one, both horticulturally and botanically, and is at the same time an important economic crop as well as a garden novelty.

L. C. CORBETT.

PEAR. A popular fruit and tree of the genus *Pyrus*, long cultivated and much modified.

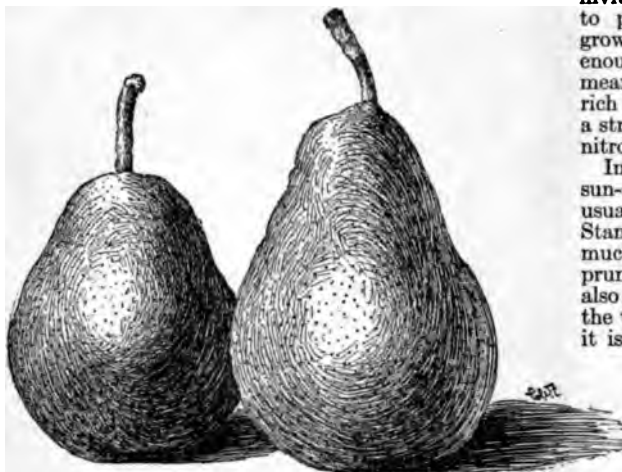
The cultivated pear, as known in North America, is derived from two distinct sources, the European *Pyrus communis* and the Oriental *Pyrus serotina*. Pears of the European stock have been grown in North America from the earliest settlement of the country. They thrive particularly well in the New England states and New York, and west to the Great Lakes, and again on the Pacific slope. In the great interior basin, pear-culture always has been precarious, due primarily to the great liability of the trees to blight. In the southern states, the climate is too hot for the best development of the tree and the best quality of the fruit. In the north prairie states, the winter climate is so severe that the pear tree will not grow. Forms of pears are shown in Figs. 2806 and 2807, as representing the common species.

Some time before the middle of the preceding century the sand or Chinese pear (*Pyrus serotina*, formerly and, as it now appears, erroneously, identified as *P. sinensis*), Fig. 2808, was introduced into the eastern states, although it attracted little attention. It soon hybridized with the common pear, and a race of mongrel varieties was the result. Of these hybrids, only two have gained great commercial prominence. These are LeConte and Kieffer (Figs. 2809, 2810, 2811). The LeConte, which appeared about the middle of last century and which is the first of the American hybrids, so far as we know, was found to be well adapted to the southern states and its general introduction there after the close of the Civil War was the beginning of commercial pear-culture in the South. It was first supposed to be blight-proof, but, in later years, orchards have been nearly decimated by the



2805. Cluster of pear flowers (*Pyrus communis*). ($\times \frac{1}{4}$)

blight, with the result that the LeConte is gradually lessening in importance and its place is being taken by the Kieffer, although the latter is by no means blight-free. The Kieffer pear originated with Peter Kieffer, of Roxborough, Philadelphia, an Alsatian gardener, who died in 1890. He grew the Chinese sand pear or Sha



2806. Bartlett pear. The pyriform or "pear-shaped" form of fruit. (X 1/2)

Lea and sold the seedlings as ornamental trees, for this species is of very distinct and handsome growth and the fruit is ornamental and fragrant. Alongside the sand pears were Bartletts. Amongst one of the batches of seedlings from the sand pear he noticed a plant with different foliage, and this he saved. Its fruit was found to be superior to the sand pear, and it was introduced as the Kieffer. It fruited in 1873. The Kieffer pear is now very popular in many parts of the country because of its great vigor, healthiness, productiveness, and the keeping qualities of the fruit. In point of quality, the fruit is distinctly inferior, but it meets the demands of the market and is an excellent fruit for canning.

Pyrus serotina itself bears a very hard pear which is inedible in the raw state, but it is excellent when used as quinces are. It is fragrant and ornamental. The tree is a most vigorous and clean grower. The plant is well worth growing as an ornamental. It is used for stock for ordinary pears, particularly in the southern states. For an historical and horticultural account of the oriental pears and their hybrids, see Bulletin No. 332, Cornell Experiment Station, by Cox (under direction of the late John Craig).

In the cold prairie countries and other parts of the cold north, Russian pears have gained some headway in recent years. These are hardy types of *Pyrus communis*. The fruit is usually of low quality, but the trees are considerably harder than the ordinary pear.

Pear-culture is the one American fruit industry which seems to show little expansion. Pears are not a popular dessert fruit in this country, and the product is largely used in canning. This is a great pity, and a loss to the people. The cultivation of the Kieffer on a large scale has probably bred a generation of people who are little aware that the pear is a fruit that may be good to eat out of hand; and the commercial and cultural difficulties are greater than with other fruits.

The pear thrives on a variety of soils, but it succeeds best on those that are rather hard clay. On sandy and loamy lands it tends to be short-lived. This is perhaps due, in part, to the fact that trees grow rapidly on such lands, and are, therefore, more liable to the attacks of blight. It is now generally accepted that trees which are making a strong and soft growth are more susceptible to blight than those which grow rather slow and firm,

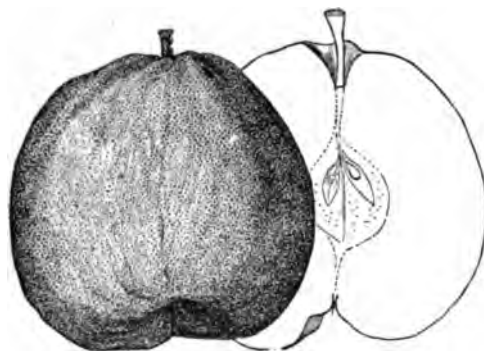
although all trees are liable to attack. Some varieties are more nearly immune than others. Caution must be exercised, therefore, in the tilling of the pear orchard. Whilst pears profit by the best tillage, as apples and potatoes do, it is easy to carry the tilling and fertilizing so far as to produce too vigorous growth and thereby invite the blight, and this disease is the one great menace to pear-culture. Therefore the most careful pear-growers use sparingly of stable manure and of nitrogenous cover-crops. They prefer to supply fertility by means of concentrated fertilizers which are not very rich in nitrogen. If, however, the trees are not making a strong and steady growth, it is as necessary to apply nitrogenous fertilizers to the pear tree as to any other.

In the interior country, pears are likely to suffer from sun-scald, and therefore the tops are started very low, usually not more than 2 or 3 feet from the ground. Standard pears (those not grown as dwarfs) are pruned much as are apple trees, except not so severely. Heavy pruning may open the top and invite sun-scald, and it also tends to make too strong and sappy growth. After the top of the pear tree is well formed and established, it is customary to do little pruning, only keeping the top fairly free and open.

The pear bears mostly on spurs which continue to branch and to bear for a number of years, and in pruning it is important that these spurs be not removed unless it is desired to thin the fruit. The flowers are borne in umbel-like cymes (Fig. 2805), but in most kinds only one fruit sets in a cluster. Pear trees are usually planted much closer than apple trees. The customary distance is 18 to 20 feet. Fig. 2812 shows an average east-American pear orchard. Fig. 2813 is a picking scene.

Many of the varieties of pears are infertile with themselves: they need the pollen of other varieties to cause them to set fruit freely. Probably any variety will fertilize any other variety in case the two bloom simultaneously. Such varieties as Kieffer and Bartlett are usually classed as self-sterile kinds, but the degree of sterility varies in different places and with different conditions. The safest plan in the setting of a pear orchard is to plant not more than two rows of one variety together, and to alternate with one or two rows of another variety.

Good varieties of pears are numerous. The one most important variety is the Bartlett (Fig. 2806), which was early introduced into the United States from Europe,



2807. The globular or apple-shaped form of fruit.—Idaho pear.

where it is known as the Bonchretien. At present, the Kieffer probably holds second place. In the eastern states, the Seckel (Fig. 2814) is a prominent variety, and is the standard of quality. Other prominent varieties are Anjou (Fig. 2815), Clairgeau, Hardy, Howell, Sheldon, and Diel. The list might be almost indefinitely extended. In the Gulf region, the oriental hybrids

alone are successful, and the leaders are Kieffer, LeConte, Garber, and Smith. The most notable pear of early American origin is undoubtedly the Seckel, which originated near Philadelphia in the eighteenth century. As late as 1880, the tree presented the appearance shown in Fig. 2816, which appeared (in larger size) in the *Gardener's Monthly*. In 1908, all that remained was a dead and decayed stump (Fig. 2817).

The season of the maturity of pears runs from mid-summer, when it is introduced by Summer Doyenne and (Manning) Elizabeth, to late winter, when it is closed with such late winter varieties as Nelis (Winter Nelis), Malines, and others. The winter pears are relatively little known in the eastern states. As a rule, they come into bearing late or are not very prolific; but there is no reason why they should not be better known. Winter pears are kept as are winter apples, although somewhat greater care is necessary. They should be stored in a uniformly cool temperature. If allowed to hang too long on the tree, they become over-ripe, and then if placed in an ordinarily warm cellar, they do not keep more than one or two months.

Unlike most other fruits, all pears are greatly improved in quality if they are ripened indoors. They should be picked as soon as they have reached their full size and have begun to color, but before they have become soft, and be placed in a dry and rather cool room. If the wind is allowed to blow over them, they are likely to shrivel. If kept too warm, they ripen too quickly and soon rot. The best quality is secured when they are picked about two weeks in advance of their normal ripening.

Pears are marketed much as are apples, although the barrel is little used for the dessert varieties. For export, as well as for a good home trade, the following sentences by George T. Powell are useful: "The fruit should be gathered when it has reached its most perfect development, but not allowed to come to its full maturity or approximate ripening. This is the right condition of fruit when it is to be shipped without refrigeration. With refrigeration, a little fuller maturity may be allowed. Each specimen should be wrapped in paper. A layer of excelsior should be placed on the bottom of the box, which is marked to be opened; over this place a sheet of paper. Pack the pears in single layers, covering each with paper and excelsior until the box is filled, nailing cover securely under considerable pressure. Boxes should hold thirty-six large pears, and sixty of medium size. [Fig. 2818.] This is a refinement of even the best packing for the common domestic trade. [Fig. 2819.]"

Dwarf pears.

When worked on the quince root, the pear is easily grown as a dwarf. The free stocks—those grown normally on pear roots—are known in this country as standards. The dwarf pear comes into bearing earlier, and, since the trees are small, the fruit can be thinned and the trees sprayed, and the fruit therefore should be of the highest quality. Dwarf pear trees require more care than the ordinary standards, however, and they should not be planted unless the cultivator understands this fact and is willing to give the attention that they need. Although the trees are by nature dwarf, since they are worked on a smaller-growing species, they nevertheless tend to become half standard if left to themselves. Therefore they must be very severely headed-in every year. A dwarf pear tree should never reach a greater height than 12 feet. To keep it down to this stature, from one-half to two-thirds of the annual growth is removed late each winter. The trees are often planted as close together as 10 feet each way, but this is too close. With the ordinary broad-top pruning, which nearly all American growers give, 1 rod apart each way is not too great. A good dwarf pear tree is one in which the union with the quince stock is very

close to the ground. When the tree is planted, this union should be 4 to 6 inches below the surface after the ground has settled. This deep planting prevents the breaking of the union and places the quince beyond the reach of borers. If planted deeper than this, the pear cion may throw out roots of its own; in fact, it sometimes does this if planted only 6 inches deep. This rooting of the stock is no particular disadvantage, although the tree thereafter tends to grow stronger and greater pruning is necessary. An expert grower can pick out the trees which are rooted from the pear stock by their more vigorous growth: if he desires to check this redundant growth he may cut off the pear roots. It is the common opinion that dwarf pear trees are



2808. The sand pear.—*Pyrus serotina*. ($\times \frac{1}{4}$)

short-lived. This may be true as regards the greater number of specimens which one sees about yards and on untilled areas, but a dwarf pear orchard on good well-drained ground, which is well-tilled and given regular pruning, will last a lifetime. Many varieties of pears do well when grafted on the quince root, but the one that is oftenest grown as a dwarf is the Angouleme (Duchesse d'Angouleme). (Fig. 2820.) This is a large pear of irregular shape which sells well because of its size, but it is of indifferent quality and may not be good enough for a special or personal market. Other varieties popular for dwarfs are Louise Bonne, Anjou, Clairgeau, Elizabeth, and, to a less extent, Bartlett and Seckel. Even Kieffer is sometimes dwarfed with satisfactory results. The growing of dwarf pears is a special practice; in general it is not commercially profitable.

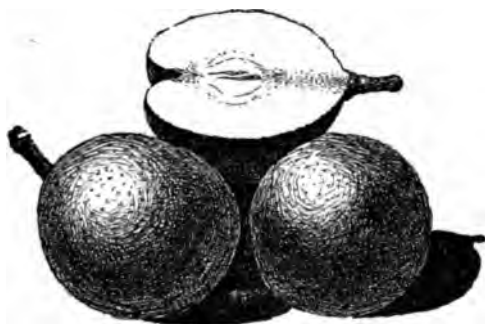
Writing on dwarf pears from a long experience in New York, L. T. Yeomans says: "The soil best adapted to dwarf pears is a rich loam, with a subsoil that requires thorough underdraining—a tile drain within 5 feet of every tree in the orchard would be thorough draining. The soil should be good strong corn or potato ground, and kept in such condition of fertility from year to year, for which purpose good well-composted barnyard manure has no equal, but may be supplemented by other fertilizers—as ground bone and potash. Small crops, as beans and potatoes, may be grown between the trees the first few years after planting, but never should they be allowed in the least to interfere with thorough tillage, or to rob the trees of proper and desira-

ble nourishment. The growth of the tree is of far greater value than any farm crops which can be grown between the trees. The soil should be thoroughly cultivated at least every ten to fifteen days during the growing season till about August 15 to September 1. It should cease in time that the wood may fully ripen. Suitable cultivation can hardly be given with any crop on the ground, except, possibly, when sufficient space is left without a crop next to the trees.

"The trees should be planted in rows 15 feet each way, or in rows 20 feet apart each way, with one tree in the center of each square. As the trees become older, the entire ground should be given up to frequent cultivation; and under no conditions should a dwarf pear orchard be seeded to grass, unless to clover for the purpose of plowing it under for fertilization.

"Dwarf pears require thorough annual pruning, which may be done at any convenient time after the falling of the foliage and before the buds become in the least swollen in the spring; but, where the cold is severe, it is better not to prune till about the first to middle of March. This pruning should begin with the first year, and be continued annually during the life of the tree, cutting back all of the growth to within four to eight buds, and thinning out all surplus branches which will not be wanted for limbs to the tree, so that at maturity the tree shall be open-headed, with opportunity for plenty of air and sunshine all through the tree, without which superior quality of fruit cannot be grown. The lower limbs should be within 20 to 24 inches of the ground. Trees when twenty to fifty years old should not be more than 12 to 14 feet high, and the diameter of the branches about 12 to 16 feet. [See Fig. 2821.] It is a very erroneous impression that a dwarf pear orchard under proper conditions is short-lived. There are in the United States orchards in vigorous condition, and now producing annual crops, that are from thirty to fifty years old.

"Some of the advantages of dwarf over standard pears are: more trees can be planted to the acre, they commence bearing much younger, the fruit is not so liable to be blown off by early winds before maturity, it is much more quickly and easily gathered than from high



2809. LeConte pear. ($\times \frac{1}{2}$)

trees, the fruit is larger and of better quality than that on standards. All varieties do not succeed equally well as dwarfs, because they do not all form an equally perfect union with the quince. Angouleme is the leading and most profitable variety now grown as dwarf, although many others succeed well."

Pears in the prairie region.

On the northern plains, the culture of pears follows the general lines of pear-growing in the Atlantic states, but there are some radical points of difference. According to C. L. Watrous, "The difficulties of pear-growing in the upper Mississippi Valley are many and grievous. Above the 40th parallel and west of the Great Lakes, nearly all efforts have been failures. The best suc-

cesses have been on high rather steep ridges and bluffs near watercourses, with light-colored clay soils and northerly exposures. Pear trees are not planted to the bottom or to the top, but in belts midway around the slopes. Plums may be used lower down and cherries above. The ground should be already set in clover or blue-grass. Small circles are spaded out for the trees. These are cultivated with the hoe and widened with the growth of the tree. Small trees branched very low are best. The trees may be cut back the second year to within a few inches of the ground. Only a very moderate annual growth is desirable. Use no manure until the tree has borne several crops of fruit, and then only with extreme care. Rich black soils, plenty of manure, and clean culture are deadly to pear trees in this region. The critical period is that of the first fruit crop. The deadly enemy is blight, which is sure to appear then. The successful pear-grower must not neglect his orchard a single day during the season of blight, but watch for the enemy and cut out and burn every blighted twig as soon as seen. Sultry damp weather in June is most critical. Such varieties as Warner, Longworth, Vermont (Beauty), Koonce, and Kieffer are said to succeed farther north and resist blight better than any others. Under slightly more favorable conditions, Clairgeau, Howell, Seckel, Tyson, Washington, and Flemish (Beauty) may be used. The hardest and blight-resistant varieties may be grown, and when in bearing a branch or two grafted with a more delicate sort with success."

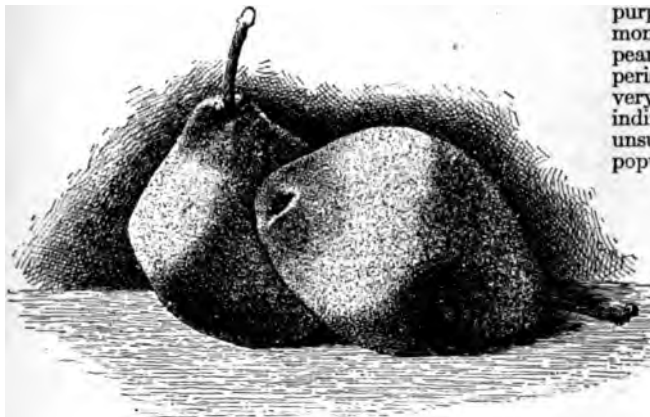
Insects and diseases.

The insect enemies of the pear are numerous, but, with two or three exceptions, are not very serious. The tree is attacked by borers, although to a less extent than peaches and apples. These are kept in check by digging them out once or twice a year as on other fruit stocks. The fruit is attacked to some extent by the codlin-moth, but the arsenical sprays keep this insect in check. Of late years the psylla, attacking the growing parts, has been very damaging in parts of the East, although it is irregular in its outbreaks. It can be controlled by thorough work with a spray in winter and also when the blossom-buds are expanding, at the former time by the use of "Black Leaf 40" tobacco preparation or kerosene emulsion and similar compounds, and at the latter period by lime-sulfur. If the rough bark is removed in winter and burned, very many of the pests will be destroyed. In some parts of the East the fruit is attacked by the pear midge, a minute fly whose maggots work in the very young fruit. Thorough cultivation will check this serious pest, but its complete control often involves the destruction of all the young fruit on the infested trees; the application of kainit to the soil in the second half of June (1,000 to 2,000 pounds to the acre on sandy soils in New Jersey) is said to kill the insect after it leaves the fruit to undergo its transformations. Repeated shallow tillage in early summer is a good protection.

The foliage and fruit of the pear are attacked by parasitic fungi, which cause the leaves to drop and the fruit to become scabby. These diseases are readily held in check by spraying with bordeaux mixture or lime-sulfur. More than fifty years ago the White Doyenne pear was the most popular variety for growing on the quince root, but because of the pear scab it passed away. It was supposed that the disease was due to uncongenial climate. Since the advent of the sprays, however, it has been found that the White Doyenne can be grown as well as ever. Flemish (Flemish Beauty) is also an example in point. Years ago it was one of the most popular standard varieties, but of late years it has been little grown because of the cracking of the fruit.

Pear-blight or fire-blight is the most serious disease of pear trees. It is an American disease. It is caused by a microbe which enters through the growing points

(flowers and tips of shoots) and thrives in soft or "succulent" parts. Gradually the micro-organism works down the stems, killing the tissues and causing the leaves to die. In the leaf-blight, which is a distinct disease, the leaves are more or less spotted and they fall; in the pear-blight, the leaves turn black and hang on the tree. The fire-blight also attacks apple trees,



2810. The Kieffer pear (pointed form), now one of the most important varieties. ($\times \frac{1}{4}$)

particularly in the Plains region. It is probably aboriginal on hawthorns and related plants. There is no perfect preventive of the disease. Some varieties seem to be relatively immune, as, for example, the Angouleme. It is now generally believed that trees are more subject to the disease when they are making excessive growth; therefore it is advised that tillage and the application of stimulating manures be moderate. As soon as the disease appears, cut out the affected parts, severing them some inches below the lowest point of visible attack. Do not allow blighted branches to remain on the tree over winter. Disinfect the wounds or stubs and the implements with bichloride of mercury or other antiseptic. Destroy hedgerows and thickets in which are other trees on which the blight is carried, as hawthorns, quinces, and diseased apple and pear trees. It is probable that there is a connection with insects in the spread of pear-blight.

Literature.

There are no recent American books on the pear. Two books have been written on this fruit: Thos. W. Fields' "Pear Culture," New York, 1858; P. T. Quinn's "Pear Culture for Profit," New York, 1869, new edition, 1883. There are bulletins from the United States Department of Agriculture and some of the state experiment stations. Many years ago the writer secured from the venerable T. T. Lyon (Vol. III, page 1585), an article, for publication, on the pear. This was published in the "Cyclopedia of American Horticulture." The Editor is glad again to place this article alongside the others in order to contrast the viewpoints of two generations. Mr. Lyon's article, which is excellent and cautious and characterized by beauty of style, is of the type that we no longer see. The person who is familiar with present-day points of view will discover that it lays the emphasis on formal presentation, propagation, pruning, varieties, whereas little or no attention is given to systems of tillage, pollination, spraying, and commercial methods. The methods in pear-culture, and the varieties, have probably changed less in the last fifteen to twenty-five years than those of any other standard fruit; as a whole, pear-culture is not extending to any marked degree; and the article that follows is still timely.

L. H. B.

The pear and its cultivation.

So far as cultivators generally are concerned, this fruit is less important than its near relative, the apple, for the reason that, while the two begin to ripen at nearly the same season, there are few, if any, desirable varieties of pears in season later than December (if we except a few austere ones, suitable only for culinary purposes), while apples are abundant for four or five months longer. Moreover, during its entire season, the pear is supplemented by the mass of luscious, though perishable, summer and autumn fruits. The liability of very many usually excellent varieties to be rendered indifferent in quality by unfavorable seasons, neglect or unsuitable soil, is also a serious detriment to the general popularity of this fruit. The liability to the loss of the trees by blight, beyond question detracts greatly from the value of the pear, especially for commercial purposes; while it also exerts a discouraging influence upon amateur planting. To the careful and discriminating amateur, as well as to the man of wealth, with a fondness for fruit-culture whether in person or by proxy, this fruit often assumes a prominence over any, if not all, others.

Extent of cultivation.

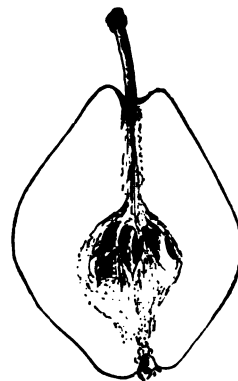
Doubtless, for reasons heretofore stated, pear trees are but sparingly planted by most persons. The fruit sent to market comes largely from the plantations of specialists who, with soils adapted to the purpose and the necessary knowledge of varieties, have undertaken the business as a commercial enterprise. In the climates of the seaboard, and, to a considerable extent, in the region of the Great Lakes, the pear is exceptionally successful; while away from the influence of large bodies of water, and especially in the prairie regions of the Mississippi Valley, from unsuitableness of climate or soil, or both combined, the trees are liable to be either killed or seriously injured in winter, and hence are short-lived and unprofitable.

Aspect.

Perhaps in no other important particular does the climate of eastern and central North America differ more widely from that of the pear-growing regions of Europe than in its liability to sudden and extreme variations of temperature. Owing to this climatic peculiarity, aspect becomes an important consideration in the selection of a location for a plantation of pear trees. As a means of avoiding the full influence of exposure to the rays of the sun, during the severe paroxysms of summer heat, while the trees are in actual growth, and also to mitigate the liability to alternate freezing and thawing in winter, a northerly or north-easterly slope is to be preferred; which, however, should be so gradual as not seriously to interfere with the convenience of cultivation. As we approach the northern limit of practicable pear-culture, however, a modification of this rule of selection may be found desirable, since, with the shorter growing season, a warmer exposure may prove necessary as a means of hastening maturity.

Soils.

While the pear tree will yield more or less satisfac-



2811. Section of the Kieffer pear, to show its ordinary form in the North.

tory results in a variety of soils, it is found to succeed most perfectly in a strong loam, of moderate depth, overlying a porous subsoil. Soils which are liable to be wet during any considerable portion of the growing season are unfit for this purpose, unless deeply and thoroughly underdrained; while even then they are quite liable not to prove fully satisfactory. A few



2812. A pear plantation.

varieties are found to be moderately successful on sandy soils, but for general planting such soils should be avoided.

Manures.

The liability of the pear tree, in this climate, to the attacks of blight is thought to be increased by excessive growth. It is, therefore, desirable that the annual growth be completed, and ripened at as early a date as practicable; and the more so since the liability to blight apparently exists only while growth is in actual progress. Stable and other nitrogenous manures should, for this reason, be applied in moderate quantities, in autumn, after the liability to excite renewed growth shall be past. Potash, lime, and phosphorus, which enter more or less largely into the composition of both tree and fruit, and which rarely exist in excess in the soil, may be profitably applied in either autumn or spring. Salt may also be profitably applied to the comparatively dry soils recommended for the pear, but with care not to apply in excess. One or even two quarts may be safely applied to each tree, before the commencement of growth in the spring, if well distributed upon the surface over a space of at least 6 or 8 feet in diameter, and left to be carried gradually into the soil by dew and rain. It is believed to possess little, if any, manurial value; but to act rather as a conservator of moisture, and probably also as a repellent of insects. Coarse mulch may be placed about the trees, covering the soil as far out as the roots extend, for the purpose of keeping the earth cool, and also to check evaporation from the soil; but this should not be done as a substitute for cultivation; and the soil beneath the mulch should be kept well pulverized.

Propagation.

(a) By seedlings: Seeds, when to be planted for the origination of new varieties, should be selected from well-grown and fully matured fruits, of such varieties as possess in a high degree the qualities sought to be reproduced or improved, since a variety in which a characteristic is strongly developed and persistently manifested is the more likely to transmit such peculiarity to its offspring. Seeds resulting from known or artificial cross-fertilization, and therefore of known and selected parentage on both sides, offer increased probability of valuable results. Seeds intended for the origination of new varieties should be planted very thinly in strong, rich, deeply prepared soil, in a single row, and covered with not more than an inch of earth, so that the young plants shall have ample space for development.

Seeds intended for the growing of stocks for nursery

purposes should be collected from varieties in which the seeds are plump and well developed, as well as from healthy, vigorous trees. American nurserymen obtain pear seeds mostly from Europe. Seeds intended for nursery stocks are usually planted in broad, shallow drills. In our American climate the foliage and unripened wood of seedling pears is very liable to be attacked

during midsummer by leaf-blight or mildew, which prematurely arrests their growth. For this reason European stocks are generally preferred by nurserymen. This attack of mildew may often be partially or wholly avoided by planting in virgin soil remote from other cultivated grounds. Pear seedlings form a very long tap-root during their first year, with few, if any, side-roots. For this reason they are taken up preferably in autumn, and the tap-roots shortened to 6 or 8 inches, when they may be replanted in nursery rows, and earthed up, or otherwise protected from heaving, or

other injury during winter; or, preferably, they may be heeled-in, in a frost-proof cellar, and planted in spring, to be budded during the ensuing summer or left to become more fully established for budding a year later.

Seedlings intended for fruiting are usually transplanted in rows, about 8 feet apart each way, with the expectation that many will be found worthless, and either removed or destroyed. Seedling pears usually require to be fruited several years before their characteristics become fully developed. This generally recognized fact may be taken as a warning that the occasional effort to hasten the puberty of a seedling by fruiting a cion from it upon a bearing tree of different variety cannot be trusted to indicate the ultimate character of the fruit of the yet incipient variety, since it is impossible to foresee to what extent such transfer may interfere with the occult formative processes through which its ultimate qualities would have been developed.

(b) By budding: Seedlings of one or two years' growth, intended for standard trees, are usually planted from 6 to 10 inches apart in the nursery row; for the reason that space, as well as cultivation, must be economized to correspond with prices, although it is impossible to grow trees of good form and properly branched of the size and age demanded by most planters when thus closely planted. Trees thus closely planted should



2813. Ladders used in picking pears.

be removed, or at least thinned, after having made one year's growth from the bud; while trees intended to be grown two or more years in the nursery row, and properly branched, should be given twice or even three times the space mentioned.

The budding of pear stocks may be done during July and August if they continue in a growing condition,

but they are liable to be attacked by mildew of the foliage, for which reason they must be closely watched, and should the malady prove troublesome the budding must be done as soon as properly matured buds can be obtained. Such stocks as, for any cause, were left unbudded at budding time, together with any in which buds shall have failed, may be grafted the following spring; but this, as well as any and all grafting of the pear, must be done very early, before the earliest movement of the sap in spring. In the spring, as soon as the swelling of the buds indicates that the germs are alive, the stocks are cut back to force them into growth. Often to insure the formation of straight, upright, symmetrical trees, careful nurserymen leave 3 or 4 inches of the stock above the insertion of the bud, to which the young shoots may be tied, if it shall fail otherwise to take an upright direction. Shoots may also be thus tied to prevent their being blown out, or otherwise injured by the wind. These stubs should be cut back to the bud when no longer needed for the purposes indicated. Such sprouts as spring from the stock in consequence of the cutting back must be removed from time to time to encourage the growth of the bud. This should be done while they are yet tender and succulent and can, therefore, be taken off without the use of a knife. This process must be repeated as they reappear, unless it is rendered unnecessary by the failure or loss of the bud.

Pruning.

Beyond that described under the head of budding, little pruning is required during the first season, except to pinch in such side shoots as threaten to rob the one intended to become the trunk of the future tree. Early in the spring of the second year, all lateral shoots must be wholly cut away, and since the pear tends strongly to renew its growth from the terminal buds of the previous year, the shoot intended to become the trunk of the future tree must be cut down to the point at which the top is to commence, when the branches to form the head will start from the buds nearest the top. The uppermost shoot must, if needful, be confined in an upright position to constitute the continuation of the trunk.

The habits of growth of varieties differ so widely that no inflexible rule can be laid down to determine the height at which the top of a pear tree should be commenced, unless it be that the heads of the more spreading varieties should be started higher than those of a more upright habit. The preferences of the larger number of purchasers have begotten among nurserymen the practice of forming the heads of all varieties at a height of 3 or 4 feet. This height is open to the objection that, while not seriously faulty in the case of such spreading varieties as Onondaga, Osband (Summer), or Flemish (Beauty), it is essentially unsuited to such very upright growers as Buffum, Sterling, Clapp (Favorite), and even Anjou. In this particular, as in various others, the practice of nurserymen, begotten by the preferences of the average of their customers, fails to adapt itself to the needs of the more intelligent and considerate orchardist, and to those of even smaller planters, who regard the health and productiveness of their trees as of higher importance than the possibly increased convenience of cultivation.

A proper system of primary branches, upon which to grow a permanent head, should be provided from the growth of the second season. Probably the most satisfactory provision for this purpose consists of a central shoot, with from three to five laterals diverging from the trunk at its base. A head should, in no case, be grown upon two shoots, forming a crotch, since this will be very liable to split and thus ruin the tree. A few varieties, of which Rostiezer is a notable example, have the habit of producing but few branches, and also of making successive annual growths, mainly from the terminal buds of the previous year, thus forming a too

open or straggling head. Such tendency is best overcome by cutting back the branches in spring, the effect being to increase their number, though at the expense of vigor.

After the primary branches have been developed, and the growth of the third year is in progress, comparatively little pruning will be found necessary beyond the occasional cutting away of a straggling or crossing branch, although there is a class of varieties, of which Summer Doyenne and Winter Nelis are types, which, especially when growing vigorously, incline to twist and



2814. Seckel, the standard of quality. ($\times \frac{1}{2}$)

straggle so awkwardly that the branches must frequently be tied in position to insure the formation of a satisfactory head.

Prior to the third or fourth year, all pruning must necessarily have for its object the direction and encouragement of wood-growth, for which purpose it is most effective when performed in late winter or early spring, while the trees are yet dormant.

The fact should not be forgotten that pruning, in proportion to its extent or severity, may be a tax upon the vigor and health of the tree, and, therefore, to be practised as sparingly as possible. Such necessity may be to a considerable extent avoided if the orchardist, with a well-defined ideal in mind of a tree such as he desires to produce, will, during the growing season, pass frequently through his plantation and pinch out, while yet small and succulent, all growths not needed for his purpose, at the same time "stopping" such of the reserved ones as may be too far outgrowing their fellows. With the efficient performance of this process while the framework of the top is being developed, very little pruning will remain to be done on the arrival of spring, while nearly the entire growth, which would otherwise have been pruned away in spring, will have been employed in developing the reserved branches.

While the cutting away of an occasional small branch may be done at almost any time, large branches should be removed only in case of actual necessity, and at a period early enough to permit the thorough drying and hardening of the cut surface prior to the movement of the sap in spring, as a means of preventing bleeding and consequent decay.

Summer pruning tends to check rather than encourage wood-growth, and since it acts to a greater or less extent as an obstruction to the circulation, it also tends,

as does the permanent bending of the branches and the hardening of the tissues, to hasten the formation of fruit-buds and the production of fruit.

The pear may be successfully grafted upon the white thorn, the mountain-ash, and the apple, and such grafts have occasionally proved more or less productive for a time, but in such cases the union between stock and cion is generally, if not always, imperfect; and such uncongenial combinations are therefore usually short-lived. The quince is the only dissimilar stock upon which the pear is extensively grown. Quince stocks for this purpose are largely imported from France. The Angers quince is generally preferred for this purpose. These stocks are usually planted in nursery rows at the age of two years, to be budded during the following summer, in the same manner as pear stocks. When intended for dwarf trees, nurserymen usually cut them back after one year's growth from the bud to the nearly uniform height of 18 inches, although with the more



2815. Anjou, one of the popular late autumn and early winter pears. ($\times \frac{1}{2}$)

upright-growing varieties it is by many deemed preferable to branch them even 6 or 8 inches lower. Aside from the height at which they should be branched, the pruning and management should be identical with that prescribed for standards, with the important exception that when planted out for fruiting the junction between the quince and the pear should be 3 or 4 inches below the surface to encourage the formation of roots from the pear. Trees thus planted will begin to bear while yet growing solely from the quince stock, and will continue to produce fruit after rooting from the pear, thus affording the early fruiting of the dwarf, as well as the permanency of the standard.

Not more than a specimen or two should be permitted to grow upon a dwarf the first and second years after planting. Such trees, if left to fruit freely, will almost certainly be ruined from overbearing before they are fully established. Many varieties when grown as dwarfs can never be safely allowed to mature more than a small portion of the fruit which they will naturally set.

While several varieties are found to be especially successful when grown upon the quince, most others prove only moderately so, requiring careful and expert management to insure satisfactory results. A few others,

of which Bosc may be named as a prominent case, are obstinately unsuccessful upon the quince, and even when double-worked upon a dwarf of a congenial variety, their success appears to be by no means assured.

Dwarf trees trained as hereinbefore specified are commonly known as half-standards. Other and more elaborate forms are known as pyramids, cordons, and the like, descriptions of which are not deemed necessary here.

Choice of trees.

Aside from the selection of the location for an orchard, the first important particular is the selection of the trees, leaving the choice of varieties for subsequent consideration. Trees of one year's growth from the bud are to be preferred for the following reasons: (1) Fewer roots need be injured or lost in the process of lifting and replanting, for which reason the tree may be expected the more promptly to recover from the shock of removal. (2) The single season's growth may be cut back and the top commenced to suit the preferences of the planter. (3) The top will present little or no obstacle to the force of the wind until the roots shall have gained such hold upon the soil that there will remain little liability to displacement from this cause. (4) The risk of failure from removal is greatly diminished, while the more prompt recovery and increased rate of growth of the trees in the more open orchard rows may be expected to compensate fully for one or two years more of growth in crowded nursery rows. (5) Something will also be saved in the cost of the trees and in the expense of transportation, as well as in the labor of planting.

If older or high-branched trees are not objected to, it will usually be found that they are but imperfectly branched from having been grown in crowded rows.

Preparation of the soil.

When the late John A. Warder was asked how large the holes should be dug for planting orchard trees, he replied, "Of the full size of the orchard;" and it may also be remarked that when the ground for an orchard has been well tilled and fertilized to a depth at least equal to that at which trees are to be planted, there is no longer occasion for holes larger than shall be necessary to receive the roots in their proper position. If the subsoil be not freely pervious to water, the ground must be deeply and thoroughly underdrained, and in no case should the hole in which a tree is to be planted be sunk into a subsoil so impervious as to retain water beneath or about its roots. If such retentive subsoil occurs too near the surface and is not considered suitable to be mixed with the surface soil, it should be thoroughly disintegrated to the requisite depth by means of a subsoil plow or other equivalent device. In all nearly level retentive soils, it will be found advantageous to "back-furrow" a land along the line of each row in the direction of the surface drainage, so that when the trees have been planted the drainage will be away from them.

Laying out, staking, and planting.

The most economical mode of laying out and planting an orchard, so far as space is concerned, is doubtless that commonly, but erroneously, designated as quincunx, and more correctly as hexagonal; but whether planted thus, or in rectangles, the work may be most rapidly and accurately done by planting a stake where each tree is to stand, and using what is known as a planting-board, consisting of a strip of board 6 or 7 feet long, with a hole for a stake near each end, and a notch or slot intermediate and in line between them to receive the stake, and to support the tree while the earth is being carefully filled in, under, among, and above its roots.

The following are good general rules to be observed

in the digging, handling, preparing, and planting of trees:

1. In digging trees, aim to secure as many of the main fibrous roots as possible.

2. Expose the roots as little as possible to the drying influence of sun and wind.

3. Prepare the roots for planting by cutting away the bruised and broken portions.

4. If the roots have been essentially shortened in lifting, cut away the superfluous branches and also cut back such as are to remain till a proper balance of root and top is secured.

5. In heavy retentive soil, plant the tree very little if any deeper than it stood in the nursery, and, in addition, raise a slight mound about the trunk to avoid the occurrence of standing water at that point.

6. In strong but dry soil, a tree may be planted an inch or two deeper than it stood in the nursery.

7. In light sand, with dry subsoil, a tree should be planted 3 or even 4 inches deeper than it stood in the nursery.

8. Dig the hole in which a tree is to be planted deep enough to receive 2 or 3 inches of fine soil, before putting the tree in place, making it large enough to allow the roots to be spread out in their natural position.

9. See that good, friable surface soil is well filled in beneath, among, and over the roots.

10. Should the soil be dry, with no immediate prospect of rain, it will be well after nearly filling the hole with earth, to apply a pail of water, and, after it shall have settled away, to fill up the hole with earth and tramp it down firmly. Staking will rarely be found necessary, except, possibly, in the case of trees old enough to have been already branched, but such stake must be watched and the tree protected against injury by rubbing against it.

Subsequent cultivation.

(a) Newly planted trees: Ground occupied by young trees must be kept well cultivated during the spring and



2816. The Seckel pear tree as it stood in 1880.

early summer. If hoed crops are planted, larger quantities of manure will be required; but, in either case, cultivation should cease as early as the beginning of August in order to hasten the ripening of the young wood. This process should be continued during at least five or six years, after which green crops may be grown and plowed under as a means, in part, of maintaining the fertility of the soil.

(b) Mulching: Especially during the first few years

after planting, in case of hot dry weather during the growing season, mulch may be applied to check evaporation from the soil and to keep it cool, but it should not be permitted to take the place of cultivation. The soil should be well pulverized before applying it.

(c) Manuring: As stated previously, manures should be applied sparingly but regularly, preferably in late autumn, and should be plowed under, or otherwise mixed with the soil at that time or in the early spring, as a means of promoting early growth and the thorough ripening of the wood in advance of severe cold.

Thorough maturing of the wood should also be assisted, as already said, by ceasing cultivation the early part of August.



2817. Stump of the Seckel pear tree. 1908.

Gathering and ripening the fruit.

All selected pears, whether intended for the market or for use at home, should be carefully hand-picked.

(a) Gathering summer and autumn pears: With very few exceptions all pears acquire a higher quality if gathered before they are fully ripe. The generally accepted rule is to gather the crop when an occasionally full-grown wormy specimen is ripe, or when there is a perceptible change in the color of the maturer specimens, or when the stem parts readily from the branch if the fruit is slightly lifted.

(b) Ripening summer and winter pears: When gathered, the fruit should be placed in a cool room devoted to the purpose, and spread upon shelves, or in lack of a suitable room they may be placed in shallow boxes or drawers, where in due time they will acquire their full color and flavor. Since this fruit parts with moisture quite freely, it, and especially the later ripening varieties, should be protected from a drying atmosphere, particularly from drafts of air, which will cause the fruit to shrivel and become tough and leathery. It is also true of at least very many varieties that even if blown off or gathered when but two-thirds grown, the fruit if put away as already described will usually acquire a satisfactory quality. Fruits thus gathered and ripened are found to have less tendency to decay rapidly at the core.

(c) Gathering and ripening of winter dessert pears: These should remain upon the tree as long as practicable without danger from frost. When gathered, they should be placed in a cool frost-proof room, and it will be well also to wrap each separately in soft paper. Some varieties are found to ripen perfectly without further attention, but the quality of most kinds will be much improved if they are brought into a temperature of 60° or 70° a fortnight before their usual season of maturity.

(d) Winter cooking pears: These should be gathered and put away in close packages in a cool, frost-proof room, in the same manner as russet apples, like which they will shrivel, and become tough and leathery if left exposed to the air. They may remain in this condition until needed for use.

Packing and marketing.

In America, pears are generally packed for market directly from the tree, without awaiting the process of ripening. Barrels are largely used as packages, although this fruit is frequently put up in half-barrels and sometimes in bushel, peck, and even in half-peck baskets.

American growers rarely ripen their fruit before marketing it. This, if done at all, is more generally accomplished by the dealer, doubtless with decided profit, since in the larger cities fully \$50 have been known to be paid for a single barrel of selected fruit, and yet the same fruit ripened and offered in quantities to suit customers has been sold at two or three times the original cost. The marketing of unripened pears is obviously unprofitable so far as the producer is concerned.

In Europe, the choicest fruits are carefully selected and house-ripened. When approaching their best condition the fruits are separately wrapped in soft paper, and are then put up in packages of perhaps one or two dozens, and sent so as to appear upon the market when in the best possible condition. Such fruits command prices quite in excess of what they would have realized had they been offered in an immature condition.

Varieties.

Since the popular and desirable varieties of pears may be found fully described in standard pomological works, such descriptions here are not deemed necessary. Among the very numerous varieties of pears described in such works there are doubtless many possessing high quality and other valuable characteristics, which, for some unexplained reason, have failed to attract the attention of growers.

Since varieties vary in their season of ripening with change of latitude, and often, to some extent, with change of location, even in the same latitude, the designation of such season becomes a matter of more or less difficulty. In the following lists the season given will be approximately that between parallels 42 and 43 of north latitude.

(a) Amateur pears: It is as true of the pear as of most other species of fruits that very many varieties are of small size, unattractive appearance, or of such delicate texture when ripe as to disqualify them for the market, although they may possess, in an eminent degree, the peculiar characteristics which render them desirable, and to persons of cultivated taste, indispensable for the supply of the family. Such are termed amateur pears.

The following is a list of a few of the most popular of these, arranged approximately in the order of maturity:

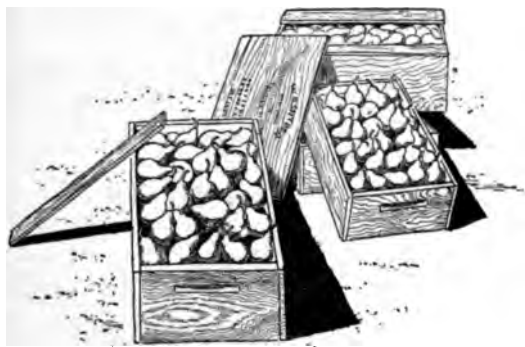
Name.	Season.*	Remarks.
Madeleine.....	m. e. July.....	Earliest good pear.
Summer Doyenne.....	e. July.....	
Bloodgood.....	e. July. m. Aug.	
Giffard.....	m. Aug.....	Excellent, but very perishable.
Dearborn.....	m. e. Aug.	
Rostiezer.....	m. Aug. m. Sept.	
Elizabeth.....	e. Aug.	
Brandywine.....	e. Aug. b. Sept.	
Tyson.....	e. Aug. b. Sept.....	A tardy bearer.
Stevens (Genesee).....	b. Sept.....	Rots soon at the core.
Clapp.....	b. m. Sept.....	Rots soon at the core.
Washington.....	m. Sept.	
(Belle) Lucrative.....	m. e. Sept.	
Bosc.....	e. Sept. Oct.	
White Doyenne.....	e. Sept. Nov.....	Liable to crack badly.
Seckel.....	Oct.	
Sarah.....	Oct.	
Anjou.....	Oct. Nov.	
Gray Doyenne.....	m. Oct. Nov.	
Reeder.....	Nov.	
Heyst (Emile d'Heyst).....	Nov. Dec.	
Mount Vernon.....	Nov. Dec.	
Dana Hovey.....	Nov. Jan.	
Langelier.....	Nov. Feb.	
Germain.....	Nov. March.	
Lawrence.....	Dec.	
Winter Nellis.....	Dec. Jan.	
Easter.....	Jan. March.	

*e, early; m, middle; b, beginning.

(b) Culinary pears: Very few dessert pears are found to be satisfactory for culinary uses, since they too generally lose at least a portion of their flavor and aroma in the process of cooking. There are, however, several varieties of high, austere character which prove adapted to this purpose, among which are the following:

Name.	Season.	Remarks.
Vicar.....	Nov. Jan.....	Occasionally good
(Black) Worcester.....	Nov. Feb.	[enough for dessert.
Catillac.....	Nov. March.	
Pound.....	Dec. Feb.	

(c) Market pears: The markets demand varieties of attractive appearance, of at least medium size and of fine texture. To the grower, productiveness and vigor of tree are also of primary importance. If possessing



2518. Packing pears in boxes.

the foregoing characteristics, a variety may prove at least temporarily popular, even though of comparatively low quality. The following varieties, some of which may also be found in the amateur list, are all more or less popular as market fruits:

Name.	Season.	Remarks.
Tyson.....	e. Aug. b. Sept.....	Excellent, but a tardy bearer.
Sterling.....	e. Aug. m. Sept.....	Productive, and exceedingly beautiful.
Clapp.....	b. m. Sept.....	Rots soon at the core.
Bartlett.....	b. e. Sept.....	Leading market pear.
(Souvenir du) Congress.....	b. e. Sept.....	Sometimes very large.
Buffum.....	m. Sept.....	Variable in quality.
Howell.....	m. Sept. Oct.	
Flemish (Beauty).....	m. e. Sept.....	Rots soon at the core.
Bosc.....	e. Sept. Oct.....	Excellent for all purposes.
Boussock.....	e. Sept. Oct.....	
Louis Bonne.....	e. Sept. Oct.....	Grown only as a dwarf.
Onondaga.....	e. Sept. Nov.	
Superfin.....	Oct.	
Sheldon.....	Oct.....	Is russeted and dull in color.
Rutter.....	Oct. Nov.	
Anjou.....	Oct. Nov.	
Kieffer.....	Oct. Nov.....	Not valuable north of 43°.
LeConte.....	Oct. Nov.....	Succeeds best at the extreme South.
Angouleme.....	Oct. Nov.....	Grown only on quince stocks.
Diel.....	Oct. Dec.	
Chirgaut.....	Oct. Jan.	
Columbia.....	Nov. Jan.	
McLaughlin.....	Nov. Jan.	
Lawrence.....	Dec.	
Maline.....	Jan. Feb.	

Relative desirableness of dwarfs.

There are a few varieties, among which Louise Bonne and Angouleme may be especially mentioned, which on free (pear) stocks are either tardy bearers or require to be fruited several years before developing their ultimate qualities, but which succeed unusually well upon the quince. These, especially the Angouleme, are valued as market varieties when grown as dwarfs.

Angouleme, and perhaps some other varieties as dwarfs, occasionally bloom so profusely as apparently to prove unable to develop the fruit, which in consequence proves abortive. The natural and obvious remedy in such case is disbudding, or its equivalent, cutting back the fruit-bearing shoots before growth is commenced.

The fact that very many varieties are not permanently successful when grown upon the quince is doubtless partially, if not in many cases even wholly,

due to their increased tendency to early and excessive productiveness when grown upon that stock, which, owing to the very common unwillingness of the grower to remove the excess of fruit, is allowed to consume the material needed for wood-growth, and thus to occasion exhaustion before the tree has gained a thorough hold upon the soil.

If, with any variety capable of forming a satisfactory union with the quince, and with the tree planted in the manner heretofore described, the entire crop of bloom or incipient fruit of the first one, two, or even three years (dependent upon the vigor of the tree) were removed, and if subsequent crops were carefully and thoroughly thinned, it is at least highly probable that permanent health and longevity would prove nearly or quite as general with dwarfs as with standards, thus permitting the more extensive growth of the pear in greater variety in small or amateur plantations and in limited grounds than is practicable with the use of standards.

T. T. LYON.

The pear in the South.

The following table from the Thirteenth Census shows the status of the pear industry in thirteen southern states, 1910 (crop data 1909):

State.	Number of trees.	Production in bushels.
Alabama.....	142,300	100,041
Arkansas.....	221,704	37,547
Florida.....	110,709	98,223
Georgia.....	262,982	149,667
Kentucky.....	337,355	251,536
Louisiana.....	57,630	35,554
Mississippi.....	118,536	101,288
North Carolina.....	243,367	84,019
Oklahoma.....	235	22
South Carolina.....	105,251	65,680
Tennessee.....	233,407	83,557
Texas.....	558,478	110,967
Virginia.....	457,177	74,486
Total.....	2,849,191	1,192,587

Throughout the whole South the average production of pears to the tree is less than one-half bushel. Virginia and Kentucky have many pear trees in comparison with the other southern states, but should hardly be considered with the remainder of the South, as their pears are produced mainly on the northern borders of the states. Texas, on account of its area, has more pear trees than any other southern state; and El Paso County, the most western county, produces over 22,000 bushels. Conditions existing in this region are not at all comparable with the other pear sections in the South.

It can hardly be said that pears are well adapted to southern conditions, although in certain sections, particularly in the mountains, it is possible to produce fruits of good quality; but on account of the blight the industry has never attained importance. At one time, the late P. J. Berckmans, of Augusta, Georgia, had 600 different pears under test in his nursery, 500 of them being named varieties. Berckmans says that of the 600, those of any worth in the South would not exceed twelve in number, and that the great commercial varieties were the LeConte, Garber, and Kieffer, although Bulletin No. 126 of the Bureau of Plant Industry shows seventy-seven varieties of pears that have originated in the thirteen southern states.

The history of the southern pear industry begins with the introduction of the LeConte into Thomasville, Georgia, in the early seventies of the last century by L. L. Varnadoe. The original cutting carried into Thomas County came from Liberty County, Georgia. This pear was planted extensively around Thomasville, being taken from there into northern Florida, southern Alabama, Mississippi, Louisiana, and Texas. The propagation was mainly by cuttings, and in the early

days of the industry \$1 apiece was often paid for trees. At one time it was conservatively stated that there were at least 200,000 trees in Thomas County. Great prices were received for the product, the growers in those days netting from \$3 to \$7 a barrel. There are reports from H. H. Sanford, one of the early growers of this fruit, of LeConte trees producing thirty bushels or more. The growing of this pear, like many other horticultural industries in the South, was along extensive rather than intensive lines. The growers thought that they did not need to till or to fertilize their lands and that they could plant these wonderful trees and reap a harvest of dollars, and for a time it seemed as if this were so; then the blight appeared. The "die-back," as it was originally called, began, and between 1890 and 1895 the industry was in a fair way to succumb. No systematic efforts were made to combat this disease, except by introduction of the Kieffer, which was considered at that time resistant, and which was largely planted in the pear sections of the South.

Because of the blight and lack of care, with no systematized methods of marketing, the pear industry of the southern states fell to a low ebb. For the past several years no commercial orchards have been set, and a great number of the trees that were planted in this early period are either dead or cut down; therefore the production of the hybrid pears in the South is not only at a standstill, but is at this time declining.

The management of these orchards, even while the industry was at its height, was very crude. It is reported on good authority that 95 per cent of the pear plantings in the southern pear sections were most seriously neglected. Some orchards were cropped, to the detriment of the land; others so badly neglected that young pine trees contended with the pears for space; consequently the fruits were not of the best quality. The growers who followed approved methods of tillage and fertilizing received a serious set-back when the blight appeared, as these plantings seemed to be more susceptible to this disease. In time a balance was



2819. Box of fancy pears; each fruit wrapped in paper.

reached, and it is now considered good practice to run the orchards in sod and every third year to give a light plowing, the application of fertilizers being determined by the growth of the tree. Spraying was little practised in the older orchards. The growers who are still producing pears now find the use of a spray-pump advisable. Harvesting during the height of the pear industry in south Georgia was aptly described by the Thomasville "Times Enterprise": "The annual slaughter of the LeConte pears has commenced. The trees are full of little gamins, picking a few, flailing some and shaking off the remainder. All—good, bad, and bruised—are dumped into barrels and rushed to market." It is unfortunately true that many of these fruits were gathered in this way. There were growers who hand-picked their product, carefully packing it into ventilated barrels. These, however, were the smaller

number. There is an instance on record of a gentleman having sold three hundred and odd dollars' worth of pears from a small orchard, on which he had expended \$5 since the last harvest. Most of the pears were shipped in barrels, though some were shipped in bulk. The distribution is still poor, and for the past few years



2820. Angouleme pear, the most popular variety for growing on quince roots.

the profits from the remaining trees have not been sufficient to warrant further planting.

At present, the South as a whole cannot be considered as a pear-producing section. There are still quite a number of pear trees around the homes. These are rapidly disappearing, due to the blight and the lack of care. The old orchards along the Atlantic and the Gulf are rapidly dying with blight. The hybrid pears, LeConte, Kieffer, and Garber, do remarkably well in this part of the country; but the pear industry will never thrive as it did once until there is a systematic fight made upon the blight. Besides this disease, the pears are subject to bitter-rot, brown-rot and crown-gall, as well as the codlin-moth and the San José scale; but of course these insects and diseases can be easily controlled by spraying.

In the catalogue of fruits appended to the Proceedings of the Thirty-Ninth Annual Session of the Georgia State Horticultural Society is to be found this remark concerning pears: "Owing to the prevalence of the pear blight, the commercial production of pears is an uncertain and hazardous industry. Until it is demonstrated that pear-blight can be successfully controlled, it is useless to recommend the planting of pears in commercial quantities. So far as is known, the Kieffer pear is the most resistant to the pear-blight of the commercial varieties." This report of the Georgia State Horticultural Society can be taken as a general recommendation for practically all of the South, except for particularly isolated and special places.

T. H. McHATTON.

The pear in California.

Visitors at the old California missions during the early part of the last century noted many thrifty seedling pear trees in the mission gardens. Many of these trees survived the neglect which came upon the mission properties after their secularization, and were in thrifty growth and bearing at the time of the American occupation. The first pears sold in San Francisco and in the mines in 1849-1850 were gathered from the old mission trees, and some of these old trees grafted over gave the first California product of the European and American varieties of more than half a century ago. From this beginning the growth of pears increased until the commercial product of 1914 included the following: 2,725 carloads sent overland to eastern and foreign markets (about the same as for the five years preceding); 2,000,000 pounds dried pears shipped to the same destination (a decreasing product because of the increasing demand for shipping fresh and canning);

805,740 cases of canned pears, mostly Bartletts—a product which is rapidly increasing. There are about 2,000,000 pear trees in California orchards. The decade 1905-1915 was a sensational period in California pear-growing because of the appearance of the pear-blight about 1902. It made such rapid progress that in 1904 practically all the pear trees in one district were seriously attacked and largely destroyed. Control measures were provided by state appropriation in 1905 and continued several years, and it was demonstrated that the disease can be held in check and profitability of trees continued by cutting out all blighted parts from twig to root—disinfecting between cuts all tools used in the work. This demonstration, coupled with an apparent lessening of the virulence of the disease, restored confidence among growers and resulted in largely increased new planting in 1914-1915.

It is a most interesting fact that a single variety furnishes a very great part, perhaps even as much as four-fifths, of the pear products of the state, and that is the Bartlett. Whatever it may lack in high quality is more than compensated for by its commercial serviceability. It is handsome and of good size, endures long carriage, cans well and dries well, and is of sufficiently good quality to please consumers: in fact the California-grown Bartlett is said to be better than the same variety grown in the Atlantic states and in the west of Europe. This is not, however, the chief reason why the Bartlett so largely preponderates in California. The ruling condition is found in the fact that owing to the marked differences in localities not widely distant and yet differing in elevation, in exposure to coast influences and away from them, and other local causes, the Bartlett has a very long ripening season, and valley, coast, and mountain Bartletts follow each other through nearly three months and thus make succession of different varieties during this period unnecessary. There is, however, at present a greater disposition than heretofore to extend the season by growing other varieties, but they are selected for resemblance to the Bartlett type. Clapp Favorite is sold as an "Early Bartlett," and a Winter Bartlett, an Oregon seedling, has been planted to carry the same style of pear as late as possible. Still some progress is being made in extending the California list of popular pears and some of local and of distant origin will probably achieve prominence, especially in the shipments to distant markets.

California pears are grown on pear-seedling roots (especially of the Japanese pear because of less liability to blight in the root), very little recourse being had to rooted cuttings or to dwarfing stocks. A dwarf pear tree is almost a curiosity. The heavier loams and even clays are sometimes planted with pear trees, not because they are best for pears but because other fruits do



2821. Dwarf pear trees forty-five years old, in a New York orchard.

worse than they. To plant fully the area intended for fruit, pears will go on the intrusions of heavy or too moist soils, while the freer soil will be given to other fruits. Still the chief product of pears is from the best loams California affords, and the profits from the tree warrant the use of such land. Pear trees are regularly pruned to a low vase form, but seldom opened in the center, the interior being used for bearing wood, and foliage enough retained partially to shade the fruit. The fruit is thinned to favor size and to relieve the tree from overbearing. Irrigation is employed in some parts of the state. The varieties chiefly grown are the following: Bartlett, Winter Nelis, Easter, Comice, Glout Morceau, Hardy, P. Barry (a California seedling), Seckel, Lawson (Comet), Winter Bartlett, Wilder.

E. J. WICKSON.

PEAR. Alligator P., *Persea gratissima*. Avocado P., *Persea gratissima*. Balsam P., *Momordica Charantia*. Garlic P., *Crotalaria gynandra*. Prickly P., *Opuntia*.

PEARL BUSH. *Ezochorda grandiflora*. P. Fruit: *Margaricarpus solutus*. P. Weed or Wort: *Sagina*.

PEAT is a kind of soil formed by the partial decay of plants in the swamps of the temperate zone. It is a standard potting material in greenhouse work for certain classes of plants, as ferns, orchids, heaths, rhododendrons, and other ericaceous plants, woody plants from Australia and the Cape of Good Hope, and many other choice and difficult subjects. American gardeners complain that they are handicapped in growing such plants because American peat is poorer than European, the lack of fiber being chiefly deplored, but it is probable that just as good peat is to be found in this country.

The peat-bogs of England are often 5 or 6 feet deep, and some of the Irish ones are said to be as deep as 40 feet. They have been forming ever since the glacial period, but are now on the decline, owing largely to natural causes. Peat-bogs consist of the remains of many kinds of aquatic and marsh plants, but chiefly sphagnum (which see). This moss grows upward and decays partially below, complete decay being prevented by the antiseptic organic acids formed in the process. Near the top the peat is brown, fibrous, light and porous; lower down it tends to be black, heavy, dense and without visible indication of its vegetable origin. The ash varies from 1 or 2 per cent in newly formed peat to 10, 20, or even 30 per cent in the older peat. Peat is commonly used for fuel by the Irish peasantry, but almost never in America, where other and better fuel is plentiful. In greenhouse work peat is valued more for its porous moisture-holding properties than for its plant-food. If dried, it may be used as an absorbent for liquid manure, "not so much for its inherent value," says Roberts (in his "Fertility of the Land"), "as for conserving the nitrogen in the manure, and for improving the condition of the stables." For this reason the half-decayed peat is extensively used in Europe, under the name of moss litter, as a bedding in stables, and later of course applied to the land.

The transformation of peat-bogs into arable land is rarely a pressing problem in America. It is usually too costly for a new country. The notion, however, is very common that peat lands are extraordinarily rich in plant-food. Nevertheless, according to Roberts, swamp muck and peat are not richer in plant-food than the good soils, with the exception of the nitrogen in the peat, which, however, is far less available than it is in good soils. (American peat contains about .67 per cent nitrogen, .21 per cent phosphoric acid, and .13 per cent potash.) Peat lands differ from good arable soil in being cold, sour, and too wet. To reclaim them, one must drain off the superfluous water and apply lime

freely to destroy the harmful organic acids. Sometimes sand or clay may be added to improve the texture of such soils. It takes time to reclaim peat lands. Thoroughly decayed peat intermingled with wet soils is muck. See the article on *Muckland-Gardening*, Vol. IV, page 2072.

WILHELM MILLER.

PECAN, *Carya Pecan*, Engler and Graeb. (*Carya olivaeformis*, Nutt. *Hicoria Pecan*, Brit.). Plate LXXXV, Vol. IV. Of the nut-trees native to North America, the pecan unquestionably ranks first in economic importance. This is true both because of the quantity and value of the wild crop and because of its cultural promise. The acceptability of the quality of the kernel and the relative thinness of shell and ease of cracking in contrast with the other hickories and the native walnuts, have since an early day continued to win favor among consumers, so that the wild crop of Louisiana and Texas long ago assumed commercial importance and for at least thirty years has, in the



2822. Foliage and flowers of pecan. The hanging parts are the staminate catkins. A pistillate catkin is below P. Details are at a (staminate flowers) and at b (a pistillate flower).

latter state, been systematically harvested and distributed in carload shipments to northern markets.

The relatively wide climatic range of the species and the extent of variation in form, size, and quality of nut have stimulated effort to develop methods of nursery propagation in widely separated localities. This has resulted in a larger and more widely scattered development of commercial nursery propagation of the pecan than of any other nut-tree.

Under favorable conditions of growth, the pecan tree attains very large size, trunk diameters of 4 to 6 feet being not infrequent, with heights ranging from 100 to 175 feet and tops spreading 60 to 70 feet. Some of the largest trees reported were in the Wabash Valley, near the northern limit of natural distribution. A tree having a girth of 18 feet 3 inches breast high from the ground, with an estimated height of 130 feet and a spread of 125 feet, is recorded by Reed in Ascension Parish, Louisiana. One having a girth of 19 feet 6 inches with an estimated height of 150 feet and spread of 100 feet, is recorded in Nachitoches Parish, Louisiana. A still larger tree near Webbers Falls, Oklahoma, has the following dimensions: Girth 23 feet 9 inches at 3 feet from ground; estimated height 180 feet.

The pecan is one of the hickories which comprise an American group of great interest. The trees are monoecious; that is, the male and female (staminate and pistillate) are separate on the same plant. (Fig. 2822; adapted from Bulletin No. 251, Bureau of Plant Industry.) The staminate or pollen-bearing flowers are in slender hanging catkins, and the pistillate or fruit-bearing flowers are in small erect or stiff clusters (Fig. 823, page 676). Several of the staminate or male flowers are shown separately at *a*, Fig. 2822, and one of the pistillate or female flowers at *b*.

Natural and cultural range.

The species is native in river-bottoms and lowlands of the Mississippi River and its tributaries as far north as Davenport, Iowa; Covington, Kentucky; Terre Haute, Indiana; and the vicinity of Kansas City, Missouri. It is also found throughout most of the river-valleys of Texas and the adjacent parts of Mexico. It does not appear to have been found native at any point in close proximity to the Gulf of Mexico. It thus occurred wild in considerable regions of Texas,



2823. Pecan tree, the Centennial, St. James Parish, Louisiana. Grafted about 1847.

Oklahoma, Louisiana, Mississippi, Alabama, Arkansas, Missouri, Kansas, Tennessee, Kentucky, Indiana, and Illinois, and small areas in southeastern Nebraska and southeastern Iowa. The species was scatteringly introduced throughout the southeastern states from Florida northward to Virginia at an early date, so that trees of considerable age are found at many points in them. The earliest efforts at commercial planting appear to have been made in Louisiana, Mississippi, and Texas, but some of the greatest activity in this direction in recent years has been outside of the native habitat, in Georgia, Florida, and South Carolina, and considerable plantings have been made also in North Carolina, Virginia, Maryland, and some on the Pacific Coast in California and Oregon.

Commercial importance.

As an article of commerce, the pecan did not receive much recognition until after the Civil War; but, increasingly large shipments of wild nuts moved northward from Louisiana and Texas from 1870 to 1890 at prices which encouraged farmers and ranchers to harvest them systematically, though not to engage in orchard planting. Early in the nineties, as the result of the marketing in New Orleans of the product of a few

individual trees yielding nuts of large size and thin shells, demand developed for such nuts at much higher prices, frequently bringing 40 to 75 cents and in some cases as high as \$1.50 to \$2.50 a pound. This stimulated interest in the planting of seedling orchards grown from the nuts of these high-priced varieties, with the result that many thousands of such trees, mostly dating to the decade 1890-1899, are now found in the Gulf and South Atlantic states. While these seedling orchards contain many productive trees yielding nuts of desirable quality, few of them have proved profitable, largely because of the wide variation in precocity, productiveness, and disease-resistance of the trees, and in the size, cracking quality, and other features of the nuts, so that a large part of the present production still consists of wild nuts. Reed estimated in 1912 ("The Pecan," Bureau of Plant Industry Bulletin No. 251) that the annual wild crop of pecans in Texas during the preceding six or eight years had varied from 3,645,000 to 17,820,000 pounds, the crop of that state being considered approximately three-fifths of the entire product. The census of 1910 reported the crop of 1909 as 9,890,769 pounds, valued at \$971,596.

While no accurate statistics regarding later production are available, the product of the orchards of named varieties planted prior to 1905 is now gradually coming to market, and may be expected to appear in rapidly increasing quantity in the future, to offset the gradually declining production of wild nuts resulting from the destruction of trees as the fertile river-bottom lands on which they stand have been brought under cultivation in farm crops.

The gradual development of power nut-cracking machinery, mainly accomplished since 1900, has resulted in a greatly increased demand for pecan meats from confectioners, which promises to keep pace with production for many years to come. These devices greatly lessen the labor cost of cracking, and render possible much more varied use of the nut.

Climatic and soil requirements.

Much confusion of thought with regard to the climatic range of the pecan has resulted from failure to recognize the difference in cold endurance of wild trees of the species in different parts of its native range. Rather early in the period of pecan exploitation, which began about 1885-1890, nuts and young trees of the large varieties conspicuous in the exhibits and advertising matter of that time were planted at many points in the northern states. These rather promptly succumbed to the winter temperatures of the North, very few surviving north of the Potomac, Ohio, and Missouri rivers. More recently, trees well worthy of propagation because of the good size and excellent quality of their nuts have been found in the surviving wild groves of the Ohio and Wabash valley bottoms in Indiana, Illinois, and Kentucky, which give promise of enduring the winters considerably farther north, and which are now in process of experimental introduction. On suitable soils it now appears probable that among these varieties of northern origin may be found sorts fairly well adapted to most of the eastern United States.

Though practically restricted in its native distribution to the low-lying moist sandy loams of the river- and creek-bottoms, gradually accumulated experience has demonstrated the suitability under cultivation of a wide range of soils. The essentials are good depth and fertility, adequate drainage, and freedom from drought. Shallow soils underlaid with hardpan or other impervious strata and loose droughty sands are unsuitable, as are mucks and peats. Occasional overflow, as experienced on creek- and river-bottom lands, is beneficial, but the pecan is about as sensitive to a water-logged soil condition as most orchard trees.

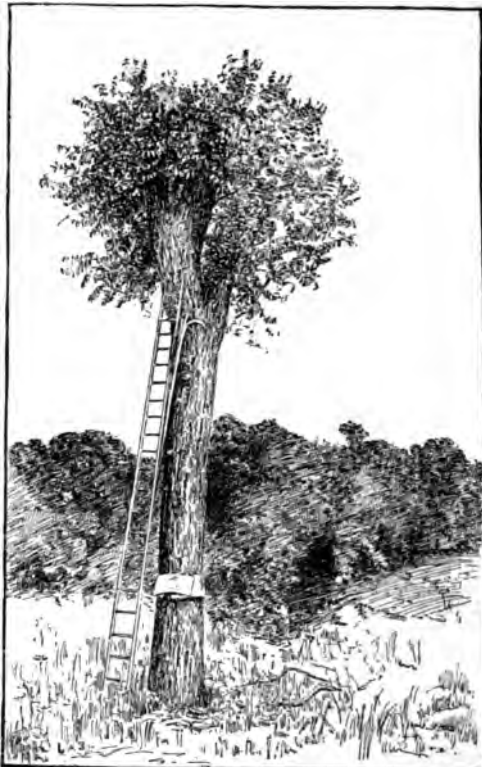
While the orchards thus far planted are too young to determine with accuracy, the area of profitable com-

mercial planting will, from present indications, be south of Pennsylvania and Iowa with some probability of success under irrigation in the Southwest and in the great valley of California.

Propagation and top-working.

Few of the earlier efforts to perpetuate trees bearing superior nuts by budding and grafting were successful, the methods commonly practised with fruit-trees in the Gulf States not proving effective with the pecan. Because of this, most of the plantings prior to 1900 were of seedling trees grown from selected parents, even where orchards as large as 500 acres were involved.

Occasionally skilful propagators succeeded in securing fair stands with crown-, trunk- and top-grafting, however, and some by annular-, patch- and chip-budding, so that by 1895 there were a number of



2824. Top-budded pecan. Four years after the operation.

budded and grafted trees of several choice varieties growing in Louisiana, Mississippi, and Texas and a few nurseries offering such trees for sale.

The earliest successful grafting was by Antoine, a slave gardener, on Oak Alley Plantation, St. James Parish, Louisiana, who, under the instruction of his owner, the late Telesphore J. Roman, in 1846 or 1847 succeeded in trunk-grafting sixteen trees of the variety later named the Centennial (Fig. 2823). Somewhat later he propagated 110 more trees of the same variety, so that 126 grafted trees of this variety were growing on that plantation at the end of the Civil War. About 1877, the late Emil Bourgeois, of Central, Louisiana, successfully top-grafted the variety now known as the Van Deman upon his Rapidan Plantation in the same parish, while in 1882 the Rome and Frotscher, as well as Centennial, were propagated by Wm. Nelson in the nursery of the late Richard Frotscher at New Orleans from the original trees in St. James and Iberia parishes. In 1886, the variety now known as Stuart

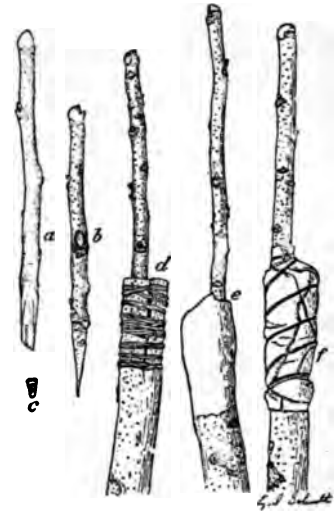
was successfully budded by the late A. G. Delmas on his place at Pascagoula, Mississippi, from the original tree of that sort on the Castanera place near by.

Successful top-working of wild trees was accomplished by E. E. Risien, of San Saba, Texas, about 1889. He transformed a number

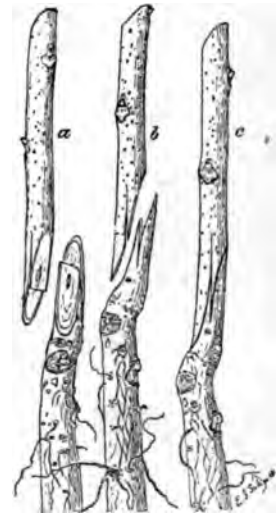
of such trees by cutting back heavily in late winter with a cross-cut saw, practically beheading trees of diameters up to 12 to 15 inches at points 20 to 30 feet from the ground. An abundant growth of strong shoots was secured by hacking the bark of the trunk for some distance down from the stubs. A sufficient number of the best of these shoots were budded in July by the annular method quickly to develop a symmetrical top. The San Saba variety was chiefly used, the original tree of this standing on Risien's place (Fig. 2824).

Although most early efforts failed, as propagators have acquired experience in pecan-propagation most of the methods of budding and grafting practised on the apple and pear have been found to succeed, so that at the present time practically all except shield-budding are more or less practised. The methods most commonly used by nurserymen are ordinary cleft- and whip-grafting, and annular-, patch-, and chip-budding.

While there has been much discussion of other stocks for the pecan and considerable individual experimentation with mockernut (*Carya alba*), pignut (*Carya glabra*), and water-hickory (*Carya aquatica*), commercial nursery propagation is practically all upon pecan stocks. Nuts from trees of vigorous growth, yielding well-filled kernels, are preferred for seed and should be from a region at least as far north as that where trees are to be planted to insure stocks of sufficient cold-endurance. Nuts for seed should not be permitted to dry out before planting in fall, or, if spring-planted, should be stratified in moist sand soon after harvest. Soil for the nursery should be rich, deep, friable, and well drained, as the control of growth during the



2825. Cleft-grafting. Successive steps in the operation: a and b, views of the cion; c, cross-section of the cion, thicker on one side; d, the cion in place and the stock securely tied to prevent splitting; e, the union covered with grafting wax; f, outer wrapping securely held with string.



2826. Whip-grafting. Early steps in the operation: a and b, front and side views of both stock and cion properly cut; c, stock and cion in position and ready for wrapping.

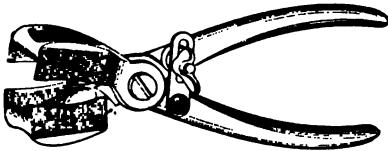
propagating season necessitates maintenance of a high state of cultivation with which clods, stones, or continued wetness seriously interfere. Nursery rows should be 5 to 6 feet apart, with nuts planted 8 to 12 inches apart in the row, 2 to 3 inches deep.

When stocks exceed $\frac{3}{4}$ inch in diameter at the point of grafting, cleft-grafting is preferred. If done above ground, the grafted stub should be securely bound with raffia or waxed cord to avoid splitting, and then thoroughly waxed and wrapped with waxed cloth to exclude air and moisture. (Fig. 2825.) Cions should be entirely dormant and have all exposed cut ends waxed to reduce evaporation. All grafting in place is best done shortly in advance of the pushing of buds on the stock. When stocks are under $\frac{3}{4}$ inch in diameter at the crown, ordinary whip-grafting in place is considerably practised, selecting cions as near the size of the stock as practicable and tying securely with raffia or waxed cloth. (Figs. 2826 and 2827.) Bench-grafting, though possible, is rarely practised with the pecan.



2827. Whip-grafting. Later steps in the operation: a, proper method of tying; b, improper method of tying; c, one year's growth following a successful union.

On account of the length of season during which these methods may be practised, annular- and patch-budding have been widely adopted by pecan-propagators, and special tools for cutting the "rings" and "patches" have come into general use in the southern states (Figs. 2828 and 2829), though expert operators succeed well with the ordinary budding-knife. These methods may be used at any time during the growing season when the bark of both stock and cion "slip" well and the bark and buds of the new growth on the cion trees are sufficiently mature to endure the necessary manipulation. The essentials are good "slipping" condition of both stock and cion, close fitting of "rings" or "patches," secure tying with raffia or other suitable material, careful attention to removal of ties and grad-



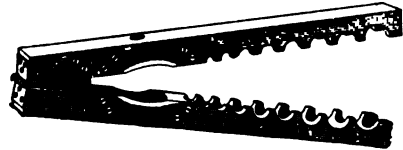
2828. A metal tool specially designed for use in annular-budding.

ual heading back of stock as growth proceeds to avoid "drowning out" the bud, and after growth begins the protection of it against splitting off or breaking down by wind and storms, by tying up to stubs or stakes. (Fig. 2830.)

One of the simplest and most effective methods is that long used by E. W. Kirkpatrick, of McKinney, Texas, commonly known as "chip-budding." This may be practised prior to and during the early growing season. Dormant cions are used. It consists essentially of the removal of a "chip" from the stock and its replacement by a bud-bearing chip of approximately identical size from the cion, which is securely tied in

place without waxing. As this method requires only the ordinary budding-knife and is equally applicable to walnut, persimmon, and other species rather difficult to propagate, it is growing in favor, especially in Louisiana and Texas. (Fig. 2831.)

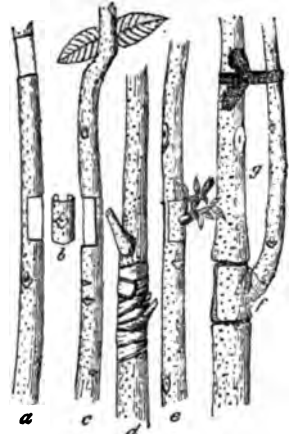
With all methods of budding and grafting, both in nursery and orchard, careful attention to the tying up of the young buds during the first growing season is required. Their soft and luxuriant growth renders them peculiarly subject to destruction by storms, the only effective protection against which is secure tying to stock, stubs, or stakes.



2829. A tool with wooden handle and steel blades specially designed for use in annular-budding.

The large number of seedling trees in orchards and gardens yielding nuts of indifferent quality is arousing much interest in top-working. This can be done by all methods described, but all top-budding or grafting should be as low in the tree as practicable to prevent the head from becoming "leggy" and "prongy."

Successful methods of budding and grafting the pecan are described by Charles L. Edwards, of Texas. The budding method is shown in Fig. 1686, page 1367, Vol. III. The crown-graft or crown-bud is shown in Fig. 2832 and is described as follows: "Buds from wood that has partially lost its vitality, or has been injured by sap starting before it is cut or after it is cut in early spring, may often be saved by this method when all others fail. But the work must be carefully done and instructions strictly observed, for if the bud is lost, the remaining stock is badly disfigured. The stock is cut off bodily at the desired height. A slit is then made at the top, the bark opened, the bud inserted and part of the flaps of bark pared away. Then the wrapper is put on so as to cover not only the cut made for the insertion of the bud, but the top of stump also. The wrapper should cover not only the stump, but should be long enough at the top to pass over and go down far enough on the opposite side to be caught by the string used for tying on the bud. The waxed cloth covering the top of the stump should be pressed down firmly before tying, and if the top of the stump is $\frac{3}{4}$ inch across or more, there should be two thicknesses of cloth put over it and firmly pressed down. On large stumps, two buds may be placed on opposite sides so as to increase chances of a 'take.' If both buds live, one of the shoots may be



2830. Annular-budding. a, Bud stick from which the bud has been removed; b, the bud ready for insertion in the matrix of the stock; c, the stock ready to receive the bud; d, the bud after being placed in position and carefully wrapped; e, growth taking place, the wrapping having been removed; f, growth from the bud supported by being tied to the stock, g, above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

removed later. In working over-grown nursery seedlings and stout wildings, this has been found to be an excellent plan. With good workmanship and favorable weather conditions, excellent savings may be had, and the bud shoots make a beautiful upright growth, with the slightest crook at the point of union. And, oddly enough, they grow straight without stakes to support them, even in a windy country. Buds put on in March and April on nursery stocks easily make a salable tree with 4 to 6 feet of bud-growth the same season in Texas. In summer work, the modified shield-bud may be peeled from the cion, but it is well to cut them to beveled edges on the sides (D, Fig. 2832) before removing from the cion. The bark of the stock fits down over them more snugly when so treated and they seem to live better. But the lower ends should always be so trimmed as to remove the fleshy rim of bark at the lower end, in order that the inner bark of the bud and the inner bark of the stock may be brought into contact. The flaps of bark folding down over the bud should always be pared down, so that the waxed wrappers may fit close and exclude those pestiferous little insects that get in under other forms of wrapper and destroy so many buds.

Another thing requiring eternal vigilance is to be sure that sap is flowing more freely in the stocks than in the budwood."

Distance, method of planting, and cultivation.

The large size of the tree and the lack of any suitable dwarfing stock render wider planting necessary than for other orchard trees. Many of the earlier orchards were spaced at 40 or 50 feet, with some planted as close as 25 feet, with a view to thinning out to 50 feet after some years of bearing. Accumulated experience indicates that upon all soils suitable for the pecan, a distance of 60 feet will be required before the age of maximum productiveness is reached, and that closer



2831. Chip- or "dormant" budding. a, The bud stick; b, the bud ready for insertion; c, the bud inserted in the matrix of the stock; d, the bud securely tied in place.

planting than this is inadvisable unless in sections where growth of trees thirty years old and upward indicates that closer distances will not involve harmful crowding and shading, to which the pecan as a nut-bearer is peculiarly sensitive. Well-ripened trees two years from the bud or graft are preferred by most planters and 24 to 30 inches of tap-root is retained in transplanting. In the Gulf States, planting is usually done during the winter months and completed by February, to insure thorough settling of earth and callusing of roots before growth starts. Special care to prevent drying out during shipment and handling is necessary, protection against sun and wind and thorough soaking of roots before planting being advisable.

Holes should be of ample size, 6 to 8 inches deeper than the roots require, and be filled in at bottom with good top-soil. Fertilizer should not be in contact with roots.

The unsatisfactory behavior of close-planted orchards and the necessity of deriving profit from the land during the six to twelve years before the trees come into bearing have given rise to varied practice in intercropping. Peaches, Satsuma oranges, truck crops, cotton, corn, and the like, are used in various sections.

It is essential on most soils to maintain good cultivation throughout the growing season. This is satis-

factorily accomplished with cotton, corn, truck crops, cowpeas or other tilled crops, provided fertility is maintained by adequate fertilizer application and plowing in of leguminous cover-crops. The laying down of pecan orchards in Bermuda-grass for pasture or mowing even on the deep moist soils of the Mississippi Delta has invariably been followed by stunting of growth and lessened productiveness of trees. The use of winter cover-crops such as hairy vetch and bur clover for plowing under in spring has everything to commend it.

Harvesting and marketing.

The preferred practice in harvesting is to permit the nuts to fall as the hulls open, gathering frequently to prevent soiling by contact with the ground. As the efficiency of this method is largely dependent on the continuance of clear and reasonably dry weather throughout the harvest season, it is usually necessary gently to "thresh" the later-maturing portion of the crop from the trees with bamboo or other light poles. Premature threshing results both in an immature quality of crop and in injury to the trees through the breaking off of fruit-spurs. After gathering, the nuts should be cured by storing in a cool dry place for two or three weeks, during which time there is some loss of weight by evaporation of moisture, after which they are ready for marketing.

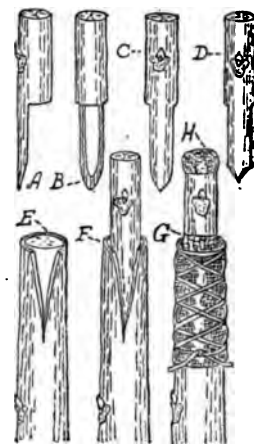
A considerable portion of the wild crop is washed and polished by friction in revolving barrels or drums. Some tinting of the nuts with dye is also practised. While polishing and tinting are not in themselves harmful, they have so frequently been used to conceal inferiority of damaged or stale nuts and such as are immature that discriminating purchasers show preference for the nuts in their natural state. This is specially true with regard to the product of the named varieties, which is coming to be sold on known varietal merit as to cracking quality, plumpness of kernel, flavor, and the like. While the product of cultivated orchards still constitutes but a small proportion of the market supply, it is destined to early and considerable increase.

Marketing by parcel post direct to consumers is coming into practice and coöperative selling by growers' associations is being undertaken to some extent.

Prices of wild nuts have risen considerably in recent years as the result of increased demand from commercial crackers. Prices of the leading orchard varieties, though gradually receding from the fictitious and novelty values of the exploitation period, range from 30 to 50 cents a pound wholesale, with good demand, and retail at 50 to 75 cents in most markets.

Varieties.

The fact that until about 1900 there were few nurserymen able to propagate the pecan by budding and grafting, coupled with the very high prices received for choice nuts from certain individual trees, stimulated the sale of nuts from such trees under varietal names for the planting of seedling orchards throughout the Gulf States. This was true to a large extent with regard



2832. The crown-graft or -bud. A, B, C, the cion; D, cion trimmed at point; E, stock ready to receive the cion; F, cion in place; G, H, the work completely protected by waxed cloth.

to Centennial, Rome, Frotcher, Stuart, Russell, Pabst, Jewett, Van Deman, Post, and Hollis, thousands of seedlings of which in dooryards and orchards are now found throughout the South. These seedlings, while frequently bearing a general resemblance to the parent, usually vary widely in important features and, as might be expected, in a large proportion of instances are inferior to the parent variety. Names have in many cases been applied to the nuts of wild trees sold for planting, with the result that much confusion has existed in the varietal nomenclature. The adoption of a code of nomenclature by the National Nut-Growers' Association in 1903, and its systematic application by a standing committee of that organization, has to a large extent clarified the situation in recent years.

The adaptability of varieties to sections, including the important feature of relative resistance to such diseases as scab under varying climatic conditions, is gradually being worked out and is essential to the establishment of commercial pecan-growing on an economically sound basis. At the present time there is much working over of trees of bearing age in progress, with the end in view of replacing the varieties originally planted by those found better adapted to the regional or local conditions.

Out of several hundred named trees, somewhat more than one hundred varieties have been propagated by nurserymen. Of these, many are as yet untested outside of the localities of their origin. Some twenty to thirty sorts have been sufficiently distributed for a long enough time to afford indication of their probable cultural range and value, with the result that a number of the earlier distributed varieties, including Centennial, Jewett, and Rome, and a number of sorts of local repute, have been practically discarded by planters.

The varietal adaptability of the pecan so far as possible to summarize as the result of several years of systematic study in the field was outlined by Reed in 1915 (Farmers' Bulletin No. 700, "Pecan Culture," with special reference to varieties and propagation) as follows:

Varieties now considered best for planting in the plains section of southeastern Virginia and eastern North Carolina are the Stuart, Mantura, Van Deman, Moneymaker, Schley, Pabst, and James.

Varieties which may be recommended for eastern South Carolina, eastern and central Georgia, central Alabama, and central Mississippi are the Schley, Stuart, Van Deman, Moneymaker, James, and Carman.

Varieties for planting in south Georgia and north Florida are the Schley, Curtis, Bradley, Alley, Van Deman, Stuart, Moneymaker, President, Pabst, and Russell.

Varieties for central and north Florida: Curtis, Bradley, Kennedy, President, Schley, Van Deman, and Moneymaker.

Varieties for the coastal section of Alabama, Mississippi, and Louisiana: Schley, Curtis, Alley, Van Deman, Russell, Stuart, Pabst, Success, and Havens.

Varieties for east Texas: Very few sorts have been given a fair trial in this section. The varieties here mentioned are recommended very largely because of their performance farther east. They are the Stuart, Moneymaker, Schley, Curtis, Van Deman, Bradley, Carman, and James.

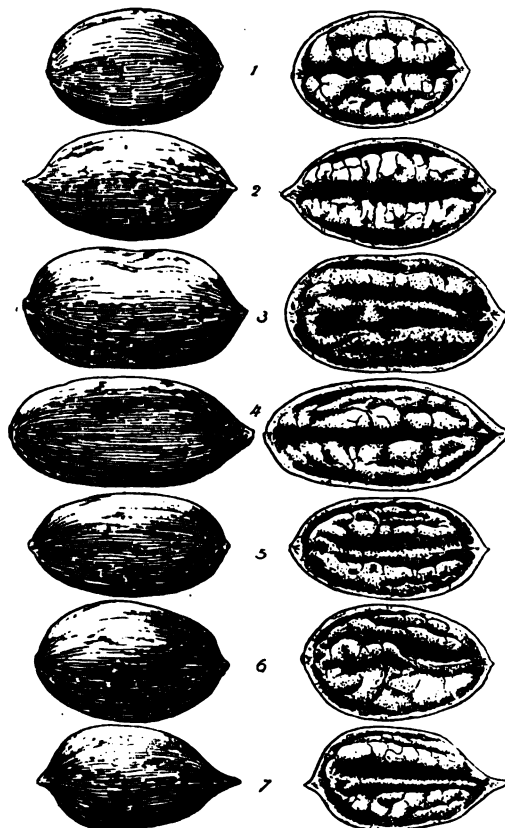
Varieties for west Texas: Sovereign (syn. Texas Prolific), Kincaid, Colorado, San Saba, Halbert, and Burckett.

Varieties for northern Louisiana, southern Arkansas, and northern Mississippi: Very few sorts have been given a fair trial in this section. The following varieties are mentioned because of certain evidence of superior hardiness which they have shown and the general merit of the nuts themselves, but they are recommended

for conservative planting only: Moneymaker, Carman, Stuart, Van Deman, Schley, Pabst, and Success.

Varieties for the section including central and western Tennessee, central and western Kentucky, southern Indiana, southern and southwestern Illinois, eastern and southern Missouri, southeastern Kansas, Oklahoma, and northern Arkansas: Only varieties of northern or local origin should be considered for planting in this general area, as none of the southern sorts is sufficiently hardy to justify their recommendation. The best of these are the Major, Niblack, Indiana, Busseron, and Posey.

Some of the best known sorts now in the trade, with locality of origin indicated, are the following:



2833. Varieties of the pecan: 1, Moneymaker; 2, Russell; 3, Frotcher; 4, Rome; 5, Alley; 6, Success; 7, Curtis. ($\times \frac{3}{4}$)

Alley (Fig. 2833).—Pascagoula, Mississippi. A thin-shelled nut of medium size, with plump kernel of good flavor. Tree a vigorous grower and heavy bearer, though subject to scab in some locations.

Busseron.—Knox County, Indiana. Recently disseminated and considered promising for Indiana and other northern sections.

Centennial (Fig. 2834).—St. James Parish, Louisiana. The first variety propagated by grafting. Exhibited at Philadelphia in 1876. A large long nut, with rather thick shell and slender kernel. Tree a symmetrical, vigorous grower but very tardy in bearing. Practically discarded in favor of better varieties.

Curtis (Fig. 2833).—Orange Heights, Florida. Though rather small in size, a thin-shelled nut with plump kernel of fine quality. Very productive and popular in Florida.

Delmas (Fig. 2834).—Pascagoula, Mississippi. A large, rather thick-shelled productive variety of very sturdy growth, but rather subject to scab. Kernel plump and of high quality.

Frotcher (syns., Eggshell, Frotcher's Eggshell, Olivier, Majestic) (Fig. 2833).—Olivier, Louisiana. One of the most widely disseminated and distinct of the older varieties. Very large and thin-shelled but with kernel rather dark and unattractive in appearance, frequently not filling well. Rapidly giving way to more reliable sorts.

Hollis (syns., Hollis's Jumbo, Jumbo, Risien, Georgia Belle, Post's Select, in part).—Bend, Texas. A medium to large, roundish

nut, rather widely disseminated for several years as Post's Select. Mainly planted in central Texas.

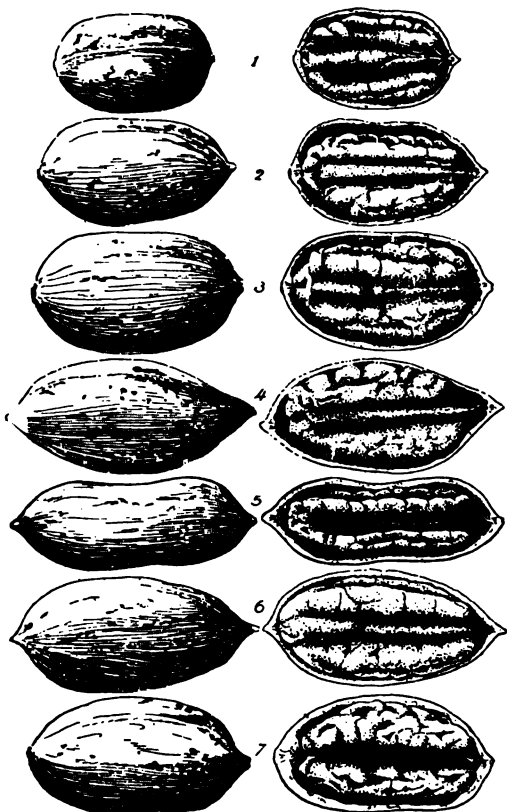
Indiana.—Knox County, Indiana. Of medium size, with thin shell and kernel of excellent quality. Promising for northern planting.

Jewett.—Pascagoula, Mississippi. Widely disseminated at one time, but generally discarded because of unproductiveness and unthriftiness of tree and unsatisfactory filling of the large long nut.

Kincaid.—San Saba, Texas. A large, oblong nut, with moderately thin shell and plump kernel of fine quality. Scabs badly in South Atlantic States.

Major.—Henderson County, Kentucky. Recently introduced, but considered promising in northern pecan territory. Of only medium size but thin-shelled, with plump kernel of fine quality.

Mobile (syns., *Laurendine*, *Bate's Perfection*).—Bayou La Batre, Alabama. A very large and handsome nut, coming into bearing early but not filling well in most sections where tested, and therefore little planted in recent years.



2834. Varieties of the pecan: 1, San Saba; 2, Teche; 3, Stuart; 4, Van Deman; 5, Centennial; 6, Schley; 7, Delmas. ($\times \frac{1}{2}$)

Money-maker (Fig. 2833).—Mound, Louisiana. A medium-sized, rather thin-shelled nut of excellent cracking and fair dessert quality. A precocious, productive sort. One of the hardiest of the southern varieties.

Niblack.—Knox County, Indiana. Recently introduced. Below medium in size, but its excellent cracking and fine dessert qualities make it promising for the North.

Pabst.—Ocean Springs, Mississippi. A large, rather thick-shelled sort with a very plump and attractive kernel of excellent quality.

Post (syn., *Post's Select*).—Milburn, Texas. Nuts and seedling trees were widely disseminated for several years under this name, at first from a tree on the Colorado River bottom near Milburn, Texas, later from other trees nearby, and still later from the Hollis tree in the same county. The nut of the original Post tree is of medium size and very attractive appearance and thousands of seedlings from it have been planted throughout the South, but neither the variety nor its seedlings are now propagated.

Rome (syns., *Columbia*, *Columbian*, *Century*, *Twentieth Century*, *Pride of the Coast*, *Southern Giant*) (Fig. 2833).—Convent, Louisiana. One of the largest varieties and for several years the most widely exploited, but now practically discarded by planters. Shell thick and kernel frequently defective.

Russell (Fig. 2833).—Ocean Springs, Mississippi. A medium-sized conical nut with very thin shell. Quality excellent when well filled but often faulty. Tree slender and tender but very productive along the Gulf Coast of Mississippi.

San Saba (syns., *Papershell*, *Risien's Papershell*, *Royal*) (Fig. 2834).—Though small, its thinness of shell, plumpness and sweetness of kernel make it a highly desirable nut where it succeeds. Tree a vigorous, though slender grower; very productive; scabs badly in eastern districts.

Schley (syn., *Admiral Schley*) (Fig. 2834).—Pascagoula, Mississippi. One of the most widely successful commercial sorts. Nut generally large, with thin shell and plump kernel of excellent quality. Tree pendulous in habit but vigorous and productive.

Sovereign (syn., *Texas Prolific*).—San Saba, Texas. Seedling of San Saba, larger than the parent, with somewhat thicker shell. Very productive in Texas but susceptible to scab in eastern districts.

Stuart (syn., *Castanera*) (Fig. 2834).—Widely planted and generally productive. Nut large, filling well but rather difficult to crack and, therefore, less planted as a commercial nut than formerly.

Success (Fig. 2833).—Ocean Springs, Mississippi. A large nut with a relatively thin shell and plump kernel.

Teche (syns., *Frotscher No. 2*, *Duplicate Frotscher*, *Fake Frotscher*, *Spurious Frotscher*) (Fig. 2834).—Probably a seedling of Frotscher, mixed with that variety in nursery and disseminated as Frotscher. Rather small and not of high quality, but very productive throughout the southeastern states.

Van Deman (syns., *Mire*, *Duminie Mire*, *Paragon*, *Bourgeois*) (Fig. 2834).—A large to very large nut, cracking well, with plump kernel of high quality. Widely planted in lower Mississippi Valley and Gulf Coast sections. Subject to scab farther east.

Hybrids.—Numerous hybrids of *C. pecan* with *C. laciniosa* and *C. aquatica* are known and some have been named and propagated in a small way. Of these the *McCallister* (syn., *Floyd*), found near Mt. Vernon, Indiana, is a very large nut, probably the largest known hickory-nut. The original tree has for many years failed to mature more than a small proportion of plump kernels and top-grafted trees of the variety have exhibited the same weakness, so that it cannot be regarded as of commercial value.

Literature.

Books and bulletins have been published on nut- and pecan-culture and varieties. Some of the works are: "Nut Culture in the United States," Division of Pomology, 1896; "The Nut Culturist," A. S. Fuller, 1896; "Nuts for Profit," John R. Parry, 1897; "Pecan Culture for Western Texas," E. E. Risien, 1904; "The Pecan and Its Culture," H. Harold Hume, 1906; "Pecans," J. B. Wight, 1906. Detailed historical accounts and descriptions of forty of the best known varieties, with colored plates, occur in Department of Agriculture Yearbooks for the years 1904-1909 and 1912.

The following bulletins on the pecan have been issued: Florida Experiment Station Bulletins Nos. 54, 57, 85; Texas Experiment Station Bulletin No. 69; North Carolina Department of Agriculture Bulletins Nos. 30, 156, 224; Georgia State College of Agriculture Bulletin No. 82; Georgia Experiment Station Bulletin No. 116; Bureau of Plant Industry Bulletins Nos. 30, 251; Farmers' Bulletin No. 700.

WM. A. TAYLOR.

PECTINARIA (comb-like). *Asclepiadaceae*. The genus as described by Haworth, not of other authors, comprises succulent leafless herbs: sts. tufted, usually procumbent, acutely, obtusely or obscurely 4-8-angled: fls. small, solitary or in fascicles in the grooves or on the sides between the angles; calyx 5-parted; corolla small, budlike, with a short cup-shaped hemispheric or broad and shallow tube and 5 lobes connate at the apex; corona double, outer cuplike and variably cut into 10 to numerous teeth or of 5 minute lobes, inner of 5 lobes incumbent upon the backs of the anthers or erect and about equaling or longer than them and connivent-erect over them; filaments of the stamens connate, forming a tube around the ovary and adnate to the dilated top of the style: follicles narrowly fusiform, glabrous.—Five species, all S. African. The following species have been intro. at Kew: *P. saz-dilis*, N. E. Br. Sts. acutely 4-angled, with flat or slightly concave sides and distant acute deltoid teeth along the angles: corolla broadly ovoid or subglobose, covered with fine hairs on the inner surface, blackish purple or purple-brown. *P. asperifolia*, N. E. Br. Sts. cylindric, with 6-8 series of closely placed tubercles: corolla papillate outside and within also pentagonally subglobose, with the papillae on the inner surface

covered with short spikelike processes, dull purplish outside, the whole surface inside frosted white, dotted with crimson.

F. TRACY HUBBARD.

PEDDIËA (named after Major Peddie). *Thymelæaceæ*. Glabrous shrubs, hardy in the extreme south of the United States.

Leaves sparse, subcoriaceous or membranaceous: fls. yellowish green, in peduncled umbels at the tips of the branches, pedicelled, perfect; perianth-tube cylindrical, lobes 4 (rarely 5?), short, spreading; stamens 8 (rarely 10?); disk hypogynous, cup-shaped, entire or toothed; ovary glabrous or densely villous at the apex, 2-celled: drupe succulent, with 2 nutlets.—About 10 species, Trop. and S. Afr.

africana, Harv. Shrub: lvs. subopposite, elliptic, nearly sessile, glabrous: fls. in terminal stalked umbels, tubular, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, 4–5-lobed, the lobes revolute: fr. a drupe with 2 stones, ovoid, about 1 in. long. S. Afr.

F. TRACY HUBBARD.

PEDICULARIS (from Latin for *louse*; application not evident). *Scrophulariaceæ*. LOUSEWORT. Herbs, mostly perennial, sometimes planted in grounds for the showy spikes of flowers and often finely cut foliage.

Mostly erect, only seldom annual or biennial: lvs. alternate or whorled (sometimes opposite), rarely subopposite, 1 to many times pinnately divided, rarely merely dentate: fls. purplish, red, rose-color to white, in spring and summer, borne mostly in a terminal bracted spike; calyx anteriorly cut, variously 2–5-toothed, sometimes also posteriorly; corolla 2-lipped, the upper one (or galea) with or without a long beak, the tube cylindrical; stamens 4, didynamous: caps. ovate or lanceolate, oblique; seeds usually few.—There are about 250 species of *Pedicularis* in many parts of the northern hemisphere (a few S. American), many of them arctic and alpine. Thirty to 40 are native in the



2835. *Pedicularis Grayi*. ($\times \frac{1}{4}$)

U. S., and the genus has a large extension in Asia. They are little known as garden plants, not being really domesticated. Some of them are adaptable to banks and borders, and others to rock-gardens and alpine work; some are swamp plants. They are likely not to persist long without renewal, as they appear to be partially parasitic and may require a particular host plant. Prop. by seeds and division. The following American species are perennial.

A. Lvs. undivided: galea long-beaked.

racemosa, Douglas. Height 12–18 in.: sts. leafy and simple or branched: lvs. lanceolate, undivided, minutely and doubly crenulate: fls. white; galea (upper lip of the corolla) with a long beak ($\frac{1}{2}$ in. long), circinate-incurved, nearly reaching the lower lip. Colo. to Brit. Col.; subalpine.

AA. Lvs. variously divided: galea with very short beak or none.

Grayi, A. Nels. (*P. procera*, Gray). Fig. 2835. Robust, $1\frac{1}{2}$ –4 ft. high, leafy: lvs. pinnately divided, the segms. lanceolate and pinnatifid and the lobes again dentate or cut, the radical lvs. 1 ft. or more long: fls. sordid yellowish and greenish striate, in a dense-fld. pubescent spike 10–20 in. long, the galea not beaked; fl.-bracts long. Mountains of Colo. and New Mex.

lanceolata, Michx. SWAMP LOUSEWORT. Glabrous or nearly so, 1–3 ft. high, simple, or branched above: lvs. alternate and opposite, pinnately lobed, upper ones sessile: fls. yellow in a short spike; bracts shorter than the fls.: caps. ovate, scarcely longer than the calyx. Aug.–Oct. Swamps, Conn. to Man., to Ohio and Neb.

canadensis, Linn. WOOD BETONY. The common American lousewort, usually more or less hairy: sts. commonly tufted, $\frac{1}{2}$ – $1\frac{1}{4}$ ft. high: lvs. mostly alternate, oblong-lanceolate, pinnately parted, all but the uppermost petioled, the lobes oblong and obtuse, incised or dentate: fls. yellow or reddish, rarely white, in a short spike that elongates in fr.: caps. lanceolate, 3 times as long as the calyx. April–June. Dry woods and thickets, Nova Scotia to Man.; south, Fla. to Mex. B.B. 3:186. B.M. 2506.

P. curripes, Hook. f. Sts. 1 ft. long, very slender and curving: lvs. far apart, 1 in. or less long, pinnatifid, the lobes 3 or 4 pairs and incised: fls. rose-colored, axillary, long-pedicelled, the stalks recurving in fr. Himalaya, 10,000 ft. B.M. 7735.—**P. foliosa**, Linn. Sts. simple, 1–3 ft.: lvs. pinnatifid, the segms. lanceolate and toothed: fls. cream-color, in a dense spike; galea very blunt. Eu. Gn. 62, p. 97.—**P. mollis**, Wall. Annual, 2–3 ft., strict: lvs. all on the st., ovate or oblong, pinnatifid, the segms. linear and crenate or pinnatifid: fls. dark pinkish purple, in strict spikes 6–16 in. long. Himalaya, Thibet, 10,000–14,000 ft. B.M. 4599. J.F. 2:166.—**P. Scetrum-Carolinum**, Linn. St. few-lvd., 3–4 ft.: lvs. pinnatifid, the lobes ovate and crenulate: fls. golden yellow, 1 in. long, in an interrupted spike, the lower lip tinged red. Eu. G.C. III. 40:385.—**P. siphonantha**, Don. Sts. 1 ft. high or less, erect or ascending: lvs. radical, linear-oblong, pinnatifid: fls. red or pink, axillary and in terminal racemes, the corolla-tube 1–6 times as long as calyx. Afghanistan to Thibet.

L. H. B.†

PEDILANTHUS (Greek, *shoe-flower*). *Euphorbiaceæ*. SLIPPER PLANT. BIRD CACTUS. REDBIRD CACTUS. SLIPPER SPURGE. JEW BUSH. Low tender cactus-like shrubs, grown in collections of succulents.

Stems thick and fleshy, juice milky: lvs. alternate, often rudimentary, the midrib thickened and often keeled below: infl. of terminal or axillary cymes; the fl. and fr. characters as in *Euphorbia*, but the involucre with a deep fissure and a short spur on the upper side, the spur containing the glands.—About 30 species in Trop. Amer. Prop. and cult. similar to the succulent *euphorbias*. See Millspaugh in Field Museum Nat. Hist., Publication 172, 1913, for a revision of the species.

A. Lobe of the involucre above the spur entire.

tithymaloides, Poit. (*Euphorbia tithymaloides*, Linn. *E. canaliculata*, Lodd. *E. carinata*, Donn). St. 4–6 ft. high: lvs. dark green, ovate or oblong, acute; midrib keeled below and dentate: involucre bright red or

purple, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, in dense terminal cymes, glabrous inside and out; pedicels of the stamens hairy, of the ovary smooth. Fla. to Venezuela. B.R. 837. L.B.C. 8:727. B.M. 2514.—Two varieties are in cult., *cucul-latus* and *variegatus*, Hort., both with white-bordered lvs.

padifolius, Poit. Sts. green, glabrous: lvs. few, oblong-ovate, obtuse: cymes terminal, open; tube of the involucre hairy only within; pedicels of both stamens and ovary hairy. W. Indies.

AA. *Lobe above the spur 2-parted; bracts of the infl. green*

aphyllus, Boiss. Branches slender, leafless: cymes terminal; the pubescent peduncle attached at the back of the involucre, which is hairy within; pedicels of the stamens and ovary glabrous. Mex.—Intro. as a wax-yielding plant.

macrocarpus, Benth. Shrubby: sts. whitish: lvs. minute: cymes open, few-fl.; peduncle attached to the center of the involucre, pedicels glabrous. W. Mex.

J. B. S. NORTON.

PEDIOCACTUS (*plains cactus*). *Cactaceae*. Globular, resembling in habit and flower the so-called mammillarias: fls. small, with a rather indefinite funnel-shaped tube; petals pinkish, broad; sepals smaller than the petals and duller in color; bracts on corolla-tube few; stamens numerous; ovary green, nearly globular, usually without bracts (rarely 1, otherwise naked), apex with a truncate or depressed scar left by the deciduous corolla: fr. dry, greenish, bursting irregularly; seeds dull black, tuberculate, keeled on the back, with a large sub-basal hilum. The fl. originates just above the spine areole on the very young tubercles, and therefore this genus belongs to the Echinocactus type rather than to the so-called mammillarias. The seeds are also of the Echinocactus type,

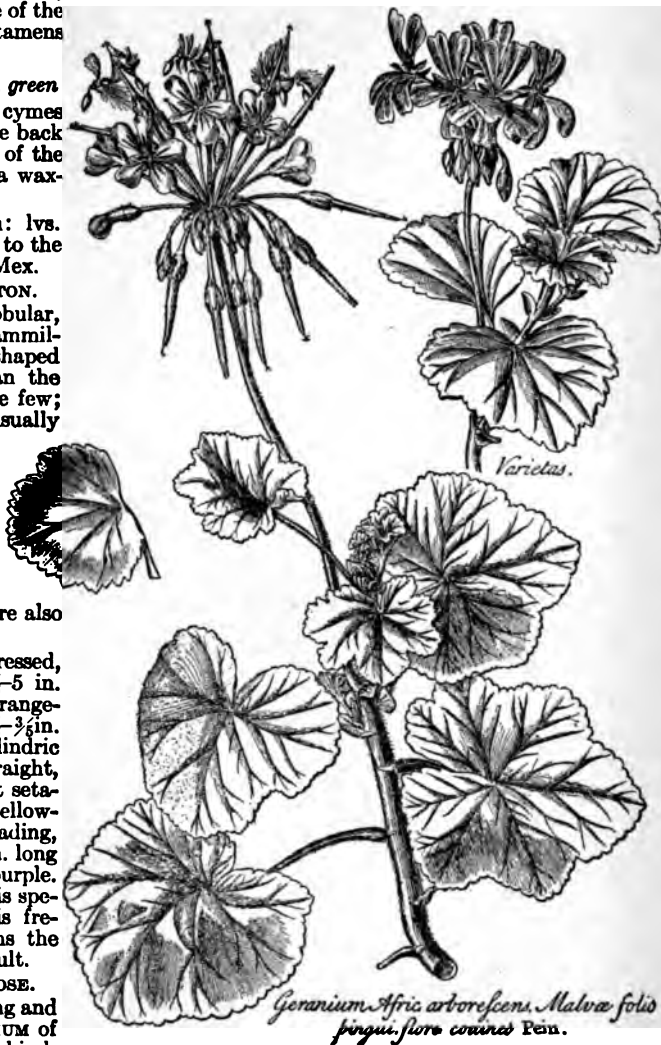
Simpsonii, Brit. & Rose. Subglobose or depressed, turbinate at base, simple, often clustered, $3\frac{1}{2}$ –5 in. diam.: ribs 8–13, only indicated by the spiral arrangement of the prominent tubercles, which are $\frac{1}{2}$ – $\frac{3}{4}$ in. long, somewhat quadrangular at base and cylindric above; exterior spines 20–30, slender, rigid, straight, whitish, $\frac{1}{8}$ – $\frac{1}{2}$ in. long, with 2–5 additional short setaceous ones above; interior spines 8–10, stouter, yellowish and reddish brown or black above, erect-spreading, $\frac{3}{8}$ – $\frac{3}{4}$ in. long; no truly central spine: fls. $\frac{3}{4}$ – $\frac{1}{2}$ in. long and nearly as broad, yellowish green to pale purple. Mountains of Colo., Wyo., Utah, and Nev.—This species does not grow well in cult., although it is frequently intro. This is the species which forms the "snake cactus" or "brain cactus" often seen in cult.

J. N. ROSE.

PELARGONIUM (*stork*, because the fruit is long and slender like a stork's bill). *Geraniaceae*. GERANIUM of gardens. PELARGONIUM. STORK'S BILL. Many kinds of pot-plants, popular for indoors and for bedding; and some of them much planted permanently out-of-doors in California and elsewhere; flowers showy.

Plants of various habit: some are fleshy and tuberous and are treated as succulents, but those commonly grown are erect or trailing leafy herbs or woody below (sometimes shrubby) with sts. somewhat soft and succulent or small and firm: lvs. mostly opposite, entire to decompound, stipulate, the foliage often strong-scented: infl. mostly umbel-like, on axillary peduncles; fls. irregular, the petals 5 (rarely fewer by abortion), the 2 upper usually larger and more prominently colored, the lower mostly narrow and rarely very small, the colors pink, red, purple, white, sometimes yellow, often attractively blotched or veined; calyx 5-parted (or the sepals said to be connate at base), the uppermost segm. produced at base into a slender nectar-bearing tube or spur adnate to the pedicel; stamens 10, of which 7 or less are anther-bearing and fertile: fr. of 5 valves, each 1-seeded and separating from the beak-

like apex mostly by coiling and more or less hygro-metrically.—Nearly all the pelargoniums are from S. Afr. All the species mentioned in this article are from that region, unless otherwise stated. Harvey, in Vol. I of Harvey & Sonder's *Flora Capensis* (1859–60), admits

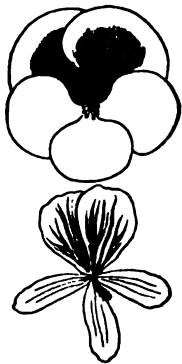


2836. *Pelargonium inquinans* (and a variety of it) as figured by Dillenius in 1732.

163 species; and his descriptions are followed closely in the characterizations of species given below. Knuth, the most recent monographer (in Engler's *Pflanzenreich*, IV. 129, 1912), admits 232 species and very many well-marked hybrids. Pelargonium is distinguished from the genus Geranium by technical characters. In most cases, the fls. of Geranium are regular, but those of Pelargonium are irregular, the 2 upper petals differing from the others in size and shape and often in coloring. The most constant difference between the two genera is the presence in Pelargonium of a nectar-tube, extending from the base of one of the sepals and adherent to the side of the calyx-tube or pedicel. This tube is not seen by the casual observer, but it may be discovered by making a longitudinal section of the fl. and pedicel.

The person who wishes to study the contemporaneous evolution of plants may find his heart's desire in Pelargonium. With great numbers of species and many

of them variable and confusing in a wild state, with plant-breeding in many places and continued through two centuries, and with a large special literature, the genus offers exceptional advantages and perplexities to the student. Most of the species early came into cultivation by the English and Dutch, the South African plants forming at one time almost a separate department of horticultural knowledge. *P. cucullatum*, the dominant parent in the florist's pelargoniums, was known in England as early as 1690. The two originals of the race of zonal or bedding geraniums were introduced into England in 1710 and 1714. Early in that century, a half-dozen species were grown at Eltham, in the famous garden of James Sherard, and these were pictured in 1732 in Dillenius' account of that garden, "Hortus Elthamensis," a sumptuously illustrated work in quarto. Even at that time, *P. inquinans* had varied markedly (see Fig. 2836). In his "Species Plantarum," 1753, Linnaeus described the few species which he knew (about twenty-five) under the



2837. Gardener's ideal, and the original form, as depicted in 1841.

genus *Geranium*. In 1787, L'Heritier founded the genus *Pelargonium*, and transferred many of the Linnaean species. L'Heritier's work "Geraniologia," a quarto, appeared in Paris in 1787 to 1788, with forty-four full-page plates. Recently Kuntze has revived the pre-Linnaean name *Geraniopernum* (1736) for this genus, but it is not likely to find acceptance.

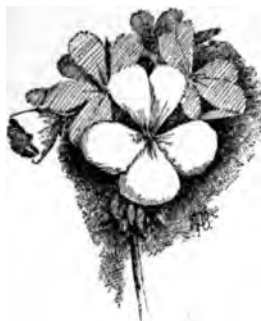
Early in the nineteenth century, many species were in cultivation in Europe, and experiments in hybridizing and breeding became common. There appears to have been something like a geranium craze. The experiments seem to have been confined largely to the development of the show or fancy pelargoniums, as greenhouse subjects, for bedding plants had not reached their present popularity. The geranium interest seems to have culminated in Robert Sweet's noble work on "Geraniaceae," published in five volumes in London, 1820 to 1830, containing 500 well-executed colored plates of geraniaceous plants. At that time many distinct garden hybrids were in cultivation, and to these Sweet gave Latin botanical names. His fifth volume is devoted chiefly to garden forms of the show pelargonium type, to which the general class name *Domesticum* is given in the following sketch. The development of the zonal or bedding geraniums had begun in Sweet's time, and he includes them in his pictures, but the larger part of their evolution is subsequent to his history. Various small works on pelargonium have appeared. De Jonghe's "Traité Méthodique de la Culture du Pelargonium," Brussels, 1844, contains good bibliographical and cultural data.

Few classes of plants should have more interest to the amateur and fancier because the species are numerous and varied, the colors mostly very attractive, the habit of the plant interesting, and the foliage often with pleasing fragrance; yet, excluding the common window and bedding geraniums of the *P. zonale* and *P. inquinans* type and the Lady Washington or Show types, they are very little known to gardeners. A cool greenhouse could be made to yield very interesting subjects in the species here described and others that may be secured from collectors in the regions where they grow.

Most of the cultivated forms of pelargonium may be grouped into four general horticultural classes:

I. The zonal, horseshoe, fish, or bedding types, known to gardeners as "geraniums." They comprise a mongrel class, designated as the Hortorum class

This race seems to be derived from *P. zonale* and *P. inquinans*. These two species were made by Linnaeus in 1753, but he founded them on descriptions in earlier works rather than directly on the plants. In America, the zonal geraniums are very popular, for they develop their colors well in the bright climate. They are popular in all countries, however. They probably stand closer to the lives of a great number of persons than any other ornamental plant. If a window or a garden can have but one plant, that plant is likely to be a geranium. The old race of large-flowered and large-clustered geraniums was known as "nosegay geraniums," because they were bouquet-like, but this term is not known in America. Another race has been developed for its zone-marked leaves. There is also a race of double-flowered



2838. Three forms of garden geranium. The upper two show the two-lipped ideal. Uppermost is Mrs. E. G. Hill; middle one, *Maculatum*; lowest, *Wistre*.

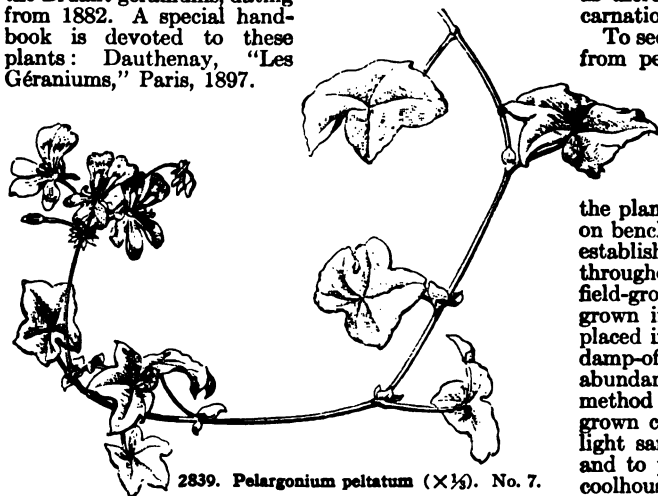
zonals, which have appeared chiefly since 1860. The very full double and close-clustered forms lose much of the grace and charm of the single types. Some of them are little better, to a sensitive eye, than balls of colored paper. In the development of the individual flower of the geranium, there have been two ideals—the English ideal for a circular flower with the petals broadened and overlapping, and the continental ideal with a somewhat two-lipped flower and the petals well separated. In the "Gardeners' Chronicle" in 1841, p. 644, the proper form is set forth in an illustration, and this is contrasted with the "original form;" the picture is reproduced, somewhat smaller, in Fig. 2837. "The long, narrow, flimsy petals of the old varieties," the writing says, "moved by every breath of wind, and separated to their very base by broad open spaces, have been succeeded by the beautiful compact flowers of the present day, with broad stout petals so entirely overlaying each other as to leave scarcely an indentation in the outline of the flower; while the coarseness which prevailed in the larger of the old sorts is replaced by a firmer substance, and a far more delicate texture." Fig. 2838 shows contrasting ideals, although the picture does not represent the extremes.

In more recent years a French type has ap-



LXXXVI. The common garden geranium, a form of *Pelargonium*.

peared under the name of "gros bois," or "large-wood" race. It is characterized as follows by Dauthenay: umbels ordinarily 4 to 5 inches in diameter: flowers very large; petals roundish, or sometimes triangular, the limb always very large and giving the corolla a remarkably round contour: leaves very large, thick and coriaceous, plane or incurved, more or less indented, strongly nerved, their diameter averaging about 5 inches, pedicels large and short: peduncles large, rigid, and projecting beyond the foliage: wood soft, fleshy, very large, often 1½ inches around. To this type Dauthenay refers the Bruant geraniums, dating from 1882. A special handbook is devoted to these plants: Dauthenay, "Les Géraniums," Paris, 1897.



2839. *Pelargonium peltatum* (X½). No. 7.

II. The ivy-leaved geraniums, products largely of *Pelargonium peltatum* (Fig. 2839). The species is said to have been introduced into England in 1701. It is a weak and straggling plant, used mostly in vases, hanging-baskets, and other places in which an overhanging subject is desired. The foliage is thick and shiny, slightly peltate and prominently angle-lobed, and the pink or reddish two-lipped flowers are always admired. Much-improved and double forms are now in commerce.

III. The "show" or fancy type is known to gardeners as "pelargonium," and in this country also as Lady Washington geraniums (Fig. 2845). These plants are very popular in Europe, being grown in numerous varieties. They are prominent at the exhibitions. Because of the hot trying summer climate, these plants are of very secondary importance in America, although there are many gardeners who succeed well with them. This race of pelargoniums seems to have descended chiefly from *P. cucullatum*, although *P. angulosum* may be nearly equally concerned in it. *P. grandiflorum* is also thought to have been a formative parent. It is probable that two or three other species are concerned in the evolution. In fact, the late Shirley Hibbard once wrote (G.C., July 3, 1880) that "it must be evident to every cultivator of these flowers that the blood of a score or so of species is mingled in them." This marked garden race, which represents no single wild species, is designated as the Domesticum group.

IV. Various scented-leaved geraniums, known mostly as "rose geraniums." These are of several species, with their hybrids and derivatives. The common rose geraniums are nearest *P. graveolens* and *P. Radula*. The nutmeg geranium is *P. odoratissimum* or *P. fragrans*.

Aside from the above groups there are several species which appear sporadically in the trade, as *P. tomentosum*, *P. echinatum*, *P. triste*, *P. quinquevulnerum*, *P. fulgidum*, and *P. quercifolium* or the derivatives of them. Few great collections of pelargonium species and varieties have been made in this country, and this is much to be regretted.

Culture of zonal geraniums. (C. W. Ward.)

While the general florist may consider geranium-culture the easiest of all gardening, the fact remains that it is as necessary to observe the requirements of the geranium as it is to observe the requirements of any other plant, in order to succeed and produce the best effects attainable. While it is true that the geranium will grow and make a good showing with comparatively little care, there is as much difference between a skillfully grown geranium plant and one carelessly grown as there is between a fancy and a common rose or carnation.

To secure the best results it is necessary to propagate from perfectly healthy stock. The dangers of over-propagation are as great with the geranium as with most other plants. To keep most varieties in good health it is necessary to plant the stock intended for propagation in the field and to propagate either from the field-grown wood in August or early September, or to lift the plants in the month of September and plant them on benches in the greenhouse, where they will become established and will maintain a vigorous constitution throughout the winter season. The propagation from field-grown wood is far less successful than from wood grown inside, and when the field-grown cuttings are placed in sand, a large percentage of them is likely to damp-off, especially if there has been a comparatively abundant rainfall in the month of July. The best method that the writer has found for striking the field-grown cuttings is to put them in 2-inch pots, using a light sandy soil free from all manure and chemicals, and to place the pots in the full sunlight either in a coolhouse or a frame. These cuttings must be kept on the dry side until the calluses have been well formed, although they should not be allowed to shrivel at any time. If the cuttings show signs of shriveling, a light syringing is preferable to a heavy watering. After the roots have started, the treatment of the plants is the same as if the cuttings had been rooted in the sand and repotted. The writer considers wood grown inside superior to field-grown wood, as the cuttings are much shorter-jointed; most of them can be taken from the plant with a heel and 95 to 100 per cent of them will root in sand in the ordinary cutting-bench.

A good temperature for the geranium propagating-house is 56° to 60°, with a bottom heat of 65° to 68°. While the cuttings are in the sand and before they are rooted, care must be taken about keeping them too moist for fear of "damping-off," or what geranium-growers know as "black-rot." As soon as the cutting is thoroughly callused and begins to emit roots, it should be potted up at once. The best soil for geraniums, according to the writer's experience, is a firm pliable clay loam; this is best if used absolutely without any manure, especially fresh manure. After potting the cuttings they should be lightly watered and shaded for a day or so if the sun is extremely hot, until the roots take hold and the foliage fills up and the stems begin to look plump. The geranium should not be grown at any time in its young state in a soil that is too rich, and care must also be taken that the plants are not kept too wet.

The geranium is subject to few diseases, and so far as the writer has been able to observe these diseases are brought on by improper treatment, such as having too much fresh rank manure in the soil or keeping the plants too wet. Too much strong plant-food in the earth combined with too much moisture induces a condition of the leaves ordinarily called "spot." It usually appears in the hottest weather or immediately after extreme heat accompanied by copious showers or rains.

Excellent specimen geranium plants may be grown in pots, especially of some of the newer French and English round-flowered varieties. In order to produce the best results, choose young vigorous plants that have

been propagated either in the latter part of August or the forepart of September, and that have shown a disposition to take hold immediately, both in rooting and in starting to grow after being potted. The soil should not be too rich, and it is best to start with the plant in a rather small pot, say 2½ inches, and proceed onward with light shifts,—that is, shifting the plant from a 2½-inch to a 3½-inch pot, and so on, letting the sizes increase an inch at each shift until a 7-, 8-, or 9-inch pot is reached, which will usually be large enough to flower the finest specimens. Whenever shifting the geranium, be sure to pot firmly, as a firm soil produces a short-jointed stocky growth, and far more bloom than a loose or over-rich soil. When the plants reach a 5- or 6-inch pot they may be regularly fed with manure-water. The most critical time for these specimen geraniums will be in the months of July, August, and September; in these periods exposure to intense sunshine should be avoided. Too much water and a close temperature are always detrimental to the geranium. Syringing the foliage frequently to keep down the temperature is also injurious. If these plants are kept under glass, a light shading or stripping upon the glass is beneficial. Probably the best position for such plants in these three extreme months is on the north side of a row of trees, some distance away from the trees, where the plants will have the benefit of the subdued shading of the foliage. If kept under glass and shaded, abundant ventilation should always be provided. As the winter approaches, a night temperature of 60° and day temperature of 70° to 75°, with plenty of ventilation in the daytime, especially in bright weather, seem best to suit the plants. Syringing ruins the flowers, and too much moisture either in the pot or upon the foliage causes the spotting of the leaves known as "dropsy." In planting the geranium in the field or in beds, always avoid an over-rich soil. The earth should be in good condition and fertile, but must not be loaded with either chemical or animal fertilizer. Too much water at any period during the hot weather produces a rank growth, reduces the quantity of bloom and in most instances induces the spotted foliage to appear.

Another disease, which is sometimes serious, especially in extremely hot seasons accompanied with a superabundance of moisture, is "stem-rot." This frequently attacks imported stock. It is most serious in intensely hot seasons; the entire plant turns black and fades and withers away. The stem-rot occurs in varieties that have been very heavily propagated.

The insects that affect the geranium are also comparatively few. The red-spider is sometimes a serious pest in summer and is difficult to get rid of when it is once well established. The only method is to syringe the plants with an extremely fine spray, and also to pick off

the leaves that are seriously affected and burn them. The green-fly is also troublesome at times, but is easily managed with the ordinary fumigation of tobacco. There is a small caterpillar that eats the foliage and sometimes proves a serious pest. If one can induce a few ground sparrows or any of the warblers, or even English sparrows, to make their home about the greenhouse, they will put a speedy end to these caterpillars. Another remedy is to go over the plants carefully and to pick the caterpillars off and destroy them. This is tedious, as it must be done frequently.

In the way of bedding geraniums, as a rule the Bruant section produces the best results, but there are a number of English and French varieties that do especially well in our hot climate. The greatest difficulty in successful geranium-culture in America is the intense heat of the summer months, chiefly July and August. Some varieties withstand the heat better than others.

Show pelargoniums. (T. D. Hatfield.)

What are known as show pelargoniums have enjoyed a long popularity. By the general public, and by old people especially, they are known as Lady Washington geraniums. They are not so commonly grown as the so-called geraniums, chiefly on account of their limited season of bloom and the fact that they cannot endure our hot midsummer suns. Through the greater part of the summer they are liable to be neglected. They also require different treatment from geraniums, and—if skill there be—more skill in cultivation.

At the end of the blooming season, they require rest,—a season of ripening the growth already made. At this time very little water will be needed, and they may be stood out in the full sun. Only the old flower-stems may be removed.

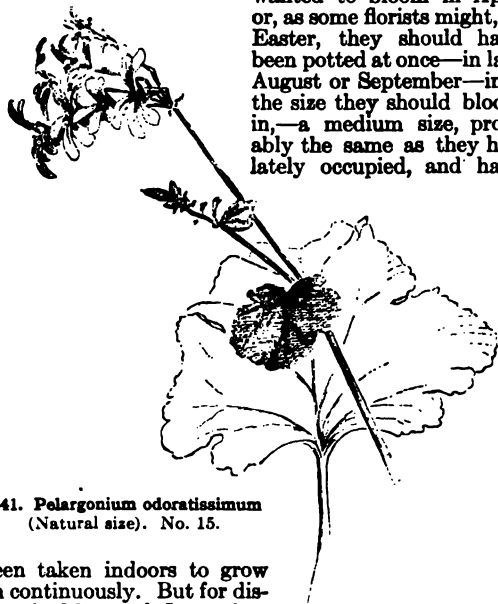
In no sense should they be cut back at this time, neither should water enough be given to encourage new growth. All the leaves should stay on until they naturally turn yellow with age, thus securing a thoroughly ripened growth. In September, one may prune them into shape, sometimes rather severely, but in any case cut out all weak and soft shoots. They should then be shaken out and repotted in a light compost, not rich, into the smallest-sized pots that will hold them, for the process of growing them on has to be gone over every season. After potting, a good soaking will be necessary, and they may be placed in a well-lighted coldframe. There is no need to keep them close; the stimulation of water, and the slight protection of a frame are usually enough to start them into new growth. No forcing will ever be needed at any season, and if the grower wished, he might keep them in a coldframe until very late in the season, so long as adequate protection against frost is afforded. They are at their best in May, and to have them in good condition, one may grow them slowly in a house averaging about



2940. Leaves of various fancy-leaved geraniums.—Hortorum (×½). No. 13.

50° night temperature (slightly less in midwinter), from October onward.

After the turn of the days—in January—re-pot them, using now a richer compost. Give a fairly good shift, depending in part on the size of plants desired, the vigor they show, and the difference in varieties. If wanted to bloom in April or, as some florists might, at Easter, they should have been potted at once—in late August or September—into the size they should bloom in,—a medium size, probably the same as they had lately occupied, and have



2841. *Pelargonium odoratissimum*
(Natural size). No. 15.

been taken indoors to grow on continuously. But for display in May and June, they are potted again in January, and some plants may be given another shift when extra vigor or the possible need of a few extra-large specimens demand it. They will need careful stopping. Some rubbing out of weak shoots, when they break abundantly, will help those that remain, and one may even have to do a little pruning. Stopping, however, must be discontinued as soon as the flowering stems begin to show, which is about the end of February in the writer's practice. These stems can be distinguished easily by a slightly different manner of growth. Up to this time the plants may be allowed to grow naturally; but if the gardener wants trained specimens he must begin to bend them as he wishes them to grow, as their growth speedily hardens and the plant will readily take and keep the form to which it is shaped.

Water should be given sparingly through the dead of winter. February and March are the months when the most growth is made, and at this time one may stimulate them materially by the judicious use of artificial manures, which may be continued, if necessary, until they come into bloom. They are much subject to the attacks of green-fly and red-spider; and as the foliage is fairly tender and liable to injury from tobacco smoke, reliance must be placed on fluid insecticides almost wholly. The blooming season is very much lengthened by giving a slight degree of shade.

The best time to take cuttings is soon after the flowering season. Often toward the last of the season, the plants make a few "growing" shoots, and these may be taken; but off and on during the summer one can get cuttings, and any time until August will do. Cuttings taken in winter-time with a heel make pretty little plants in 4- or 5-inch pots without stopping. Cuttings taken at the usual time and grown in 6- or 7-inch pots come in handy in grouping for the front lines. It is necessary to raise a few plants every season to replace older plants which have grown too large.

New varieties are raised from seed, which is freely produced. In hybridizing it does not appear that hand-

pollination has any effect, as the seedlings seldom show any particular affinity to either parent.

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I. Lvs. on the pinnate order, although sometimes entire, usually pinnately lobed or compound. (Nos. 1-5).

A. Plant with short, more or less succulent st. and tuberous or thickened roots: lvs. pinnate or pinnately parted, long-petioled: fls. in many-fl'd. dense umbels, on very short pedicels; petals 5, nearly equal; stamens 5-7, one filament broad. (Polydactylum.)

1. *triste*, Ait. (*Geranium triste*, Linn. *G. pastinacifolium* and *P. villosum*, Mill.). St. or caudex very short, succulent: lvs. large, 2-3 pinnately compound, pubescent, the ultimate teeth gland-tipped: calyx-tube long and stalk-like, much exceeding the pedicel, the lobes half as long as the petals: fls. brown-yellow with dark spots.—A well-marked species, sometimes offered in the trade. It runs into several forms. The various names and synonyms suggest the divided lvs. of the umbellifers and other plants. Var. *filipendulifolium*, Sims. Caulescent: lvs. sub-bipinnatifid, the segms. oblong. B.M. 1641. Var. *daucifolium*, Harv. (*Geranium daucifolium*, Linn.), has lf-segms. narrow-linear or linear-oblong. Var. *laxatum*, Harv., has lvs. 4-pinnate, the pinnae stalked and ultimate segms linear.

2. *quinquevulnerum*, Willd. Somewhat shrubby at base, sparingly branched, hirsute: lvs. 2-pinnatifid with linear toothed segms., the stipules broadly cordate and mucronate: fls. purple, scentless, the petals obovate, velvety, and pale-edged; calyx-tube as long as the pedicels, somewhat hairy, the lobes obtuse.—Thought by Sweet to be a hybrid of *P. triste* and *P. bicolor*, and so regarded by Knuth.

3. *fulgidum*, Ait. (*Geranium fulgidum*, Linn.). St. shrubby, densely pubescent: lvs. pinnately 3-parted, silky on both sides, the lateral segms. 3-lobed, all



2842. *Pelargonium cordatum* (× 1/4). No. 18.

deeply toothed, the terminal lobe oblong and pinnatifid; stipules acute, broadly cordate: peduncles usually branched, many-fld.; fls. small, bright scarlet, the petals obtuse; calyx-tube conspicuously swollen at the base and again just underneath the fl., thrice as long as



2843. *Pelargonium cordatum*. Leaves often are much more cordate at base. ($\times \frac{1}{2}$)

the pedicel, the lobes linear-obtuse; petals brilliant scarlet with dark lines.—Perhaps not now seen in its pure form, but it is probably a remote parent in various small-fld. scarlet geraniums. Cult. in England as early as 1723.

AA. *Plant either succulent, or shrubby and slender, the root branching: lvs. mostly cut or compound (rarely entire), pinnately formed: petals nearly equal, narrow-spatulate; fertile stamens 7. (Ligularia.)*

4. *exstipulatum*, L'Her. Shrubby, canescent: lvs. round-ovate, small, velvety, about 3-lobed, the lobes cut-toothed or lobed, the lateral lobes small; stipules adnate and very minute: peduncles slender and few-fld., with very small bracts; fls. small, white, with short spatulate petals.—Lvs. about $\frac{1}{2}$ in. across, with odor of pennyroyal. Appears not to be in the trade, at least not in a pure form.

5. *artemisiifolium*, DC. (*P. artemisioides*, Hort.). Suffrutescent, erect and slender, glabrous, nearly simple: lvs. long-petioled, 2-pinnately parted, nearly glabrous, the segms. linear-filiform and channeled; stipules free, subulate: peduncles long, 2-3-fld.; fls. white or bluish; calyx-tube swollen at base, 2-3 times as long as the lance-cuspidate segms., not ribbed; petals about twice longer than calyx-segms. or sepals, spatulate or obovate, rounded at apex, more or less veined and spotted at base. G.M. 54:629.

II. *Lvs. on the palmate order, although sometimes entire, usually lobed (Nos. 6-31).*

A. *Plant shrubby, or sometimes succulent and jointed: lvs. palmately nerved or lobed; stipules persistent and either rigid or membranaceous: petals 4 or 5, the two uppermost broadly obovate and long-clawed, very much longer than the lower ones; fertile stamens 7. (Jenkinsonia.)*

6. *Endlicherianum*, Fenzl. Herbaceous perennial, 1-1 $\frac{1}{2}$ ft. high, noteworthy in being W. Asian: st. little branched, somewhat fleshy, terete, pubescent: basal lvs. more or less numerous, glaucous, cordate-orbicular, broadly and obscurely 5-lobed, lobes crenate-dentate, with whitish appressed hairs; stipules lanceolate, hairy: fls. many in the umbel, rose-colored; spur of calyx exceeding pedicel; upper 2 petals 2-3 times longer than sepals. Asia Minor, Syria. B.M. 4946. G.C. III. 30:149. Gn. 60, p. 185. G.M. 52:214. H.F. II. 7:71.

AA. *Plant weak and usually trailing, the branches slender and not succulent: lvs. thick or fleshy and glossy, lobed, mostly marginally peltate: infl. umbellate; good stamens 7, 2 upper shorter; petals unequal. (Dibrachya.) IVY-LEAVED GERANIUMS.*

7. *peltatum*, Ait. (*Geranium peltatum*, Linn.). Fig. 2839. Plant with slender-jointed more or less zigzag

angled sts. which are glabrous or very nearly so (except at the top): lvs. glabrous or minutely pubescent, fleshy, the petiole inserted just inside the margin at the base, about 5-nerved and with 5 short wide mostly obtuse main lobes and often with smaller minor lobes or angles and notches, the margins very entire: peduncle very long, originally 4-8-fld., but now bearing many greatly modified fls., the calyx-tube slender and stalk-like, often longer than the pedicel and 2-3 times longer than the pointed nerved and mostly ciliate lobes; petals twice as long as calyx-lobes, red to white or purplish, the 2 upper ones erect and purple-blotched or striped, the 3 lower ones usually smaller and not marked and separated from the upper as if the fl. were 2-lipped. B.M. 20.—Parent of the ivy-leaved geraniums, now much improved and varied. Prized for baskets. There are forms with double fls. and colors of various kinds. It is a most desirable plant and very floriferous in most of the garden sorts. In the wild there are the following forms: Var. *glabrum*, Harv. Calyx and foliage glabrous: fls. purplish pink. Var. *scutatum*, Harv. (*P. scutatum*, Sweet). Calyx villous: lvs. glabrous. Var. *clypeatum*, Harv. (*P. clypeatum*, Steud.). Calyx and lvs. soft-pubescent. *P. latéripes*, L'Her. (*P. hederæ-folium*, Salisb.), has lvs. cordate, not peltate.

AAA. *Plant woody or herbaceous, with slender sts.: lvs. very long-petioled, palmately 5-7-nerved, lobed or cut; stipules free, ovate or lanceolate: petals unequal, the two upper ones broad; fertile stamens 7, unequal. (Eumorpha.)*

8. *grandiflorum*, Willd. Shrubby, glabrous and glaucous: lvs. long-stalked, strongly 3-7-nerved from the top of the petiole, deeply 5-7-lobed, the lobes broad



Geranium Africa arborefcens, foliis cucullatis angulof.

2844. *Pelargonium angulosum*. From Dillenius' figure in 1732. (One-half the size of the original plate.) No. 20.

and sharp-toothed, the stipules ovate and mucronate: fls. about 3 on each peduncle, the stalk-like calyx-tube 3-4 times as long as the lanceolate segms., the obovate white petals (upper 2 with red lines) 3 times as long as calyx-segms.—A handsome and distinct species, probably not now in cult. in its pure form. Intro. to England in 1794.

9. *multibracteatum*, Hochst. Somewhat shrubby below, 1-2 ft., thinly hairy but becoming glabrous: lvs. palmately about 7-cut or -lobed, the segms. broadly oblong or ovate, serrate or crenate, more or less hairy, 2-5 in. across; stipules about $\frac{1}{2}$ in. long, ovate to elliptic: peduncles long, 6 in. to 1 ft., bearing 6-10-fl. umbels; fls. whitish or white, on pedicels about $1\frac{1}{2}$ in. long; petals obovate-spatulate, entire, twice longer than the narrow sepals. Trop. Afr. G. M. 54:628.

10. *transvaalense*, Knuth (*P. Thörnicroftii*, Hort.). Erect, 16 in. to 2 ft. in bloom, the st. terete and soft-hairy, sparingly branched: lvs. few, cordate-angular in outline, 5-7-lobed, the lobes triangular or rhomboid, serrate-dentate, the petiole as long as blade or longer; stipules broadly ovate, acute: umbels many, corymbose at apex of st.; fls. nearly sessile, rose-colored or carmine-rose, or pale pink, $1\frac{1}{2}$ in. across vertically, the 2 larger petals strongly narrowed at base and emarginate at top, the 3 smaller ones paler and retuse or emarginate. Transvaal, 3,000 ft. altitude. G.C. III. 55:103.

AAAA. Plant with thick succulent branches, and strong fishy odor, shrubby in the wild and in warm countries: lvs. obovate, orbicular or reniform, shallowly if at all lobed: infl. umbel-like; good stamens 7, the 2 upper ones short; petals typically all of one color. (*Cicòdium*.) FISH or BEDDING GERANIUMS.

11. *zonale*, Willd. (*Geranium zonale*, Linn.). ZONAL or HORSESHOE GERANIUM. Shrubby, becoming woody at the base even in pots, the young branches succulent and somewhat hispid: lvs. round-cordate, glabrous or pubescent, long-stalked, usually with a zone or horse-shoe mark of deeper color on the upper surface, the margin crenate-dentate, with several very shallow rounded lobes; stipules broad, cordate-oblong: peduncles long, the many fls. nearly sessile; calyx-tube glabrous or nearly so, 4-5 times longer than the lanceolate segms.; petals separated, narrow-wedge shape or spatulate.—S. Afr., "among shrubs and on hillsides. . . . The fls. vary from scarlet and crimson through

all shades of red to pure white."—Harvey. Probably originally red. *P. zonale* was intro. into England in 1710. Linnæus described it in 1753 as *Geranium zonale*, founding the species on previous descriptions, not on specimens. It is probable that the species had been considerably modified by domestication when Linnæus wrote. There seems to be no accepted early portrait of the original form of the plant.

12. *inquinans*, Ait. (*Geranium inquinans*, Linn.). FISH GERANIUM. Fig. 2836. Plant more velvety than *P. zonale*, sometimes more or less viscid, the lvs. not zoned: lvs. long-petioled, orbicular-reniform, crenate, only obscurely many-lobed, velvety and somewhat viscid: calyx-tube densely glandular and viscid, 3-4 times longer than the lanceolate segms.; petals broadly obovate, scarlet, but now varying to lighter colors.—"Among shrubs and on hillsides." This is the *Geranium inquinans* of Linnæus, who founded the species on previous descriptions. One of the descriptions (Dillenius, in "Hortus Elthamensis," 1732) was accompanied by a picture, and this picture, reduced, is reproduced in Fig. 2836. It will be seen that even in that early day the species had varied into a form with short-notched petals and short pedicels. Intro. into England in 1714. Said by Harvey (1859-60) to be the parent of most of the "scarlet geraniums" of English gardens.

13. *hortorum* class. COMMON FISH or BEDDING GERANIUM. Fig. 2840. The common geranium in great numbers of forms, derived from the variation and probably the blending of *P. zonale* and *P. inquinans* (and possibly others) in more than a century of careful selection. The original species are not now in cult. Practically all garden geraniums have the zonal marks on the lvs., or bands, or a central blotch of variegation. Some of them have intermingled colors of green, white, and red on the same lf. Some are "silver-banded" and some "gold-banded." (See Fig. 2840.)

AAAAA. Plant with a short and thick more or less fleshy st. or caudex, from which arise slender branches, the lvs. long-stalked and reniform or cordate and obscurely lobed: stamens 6 or 7. (*Cortusina*.)

B. With spine-like stipules.

14. *echinatum*, Curt. Fleshy caudex armed with persistent spine-like stipules: lvs. long-petioled, white-tomentose, cordate-ovate and obtuse, about 3-7-shallow-lobed, the lobes rounded and crenulate: peduncle long and branched; fls. white, with a spot near the center (varying to all purple), the petals notched; calyx downy, the tube several times longer than the lobes. B.M. 309. G.C. III. 46:245. J.H. III. 49:71. G.W. 15, p. 203.—Now and then advertised. The fls. are said to change color during the day; and the color may be shades of purple. It is offered in S. Calif.

BB. Without spines.

15. *odoratissimum*, Ait. (*Geranium odoratissimum*, Linn.). NUTMEG GERANIUM. Fig. 2841. Plant lax, the sts. ascending or more or less tortuose: st. or caudex very short, throwing up many slender and weak soft-pubescent branches: lvs. very long-stalked, soft, round-cordate and very obtuse, the blade 1 in. or somewhat more in length and broader, obscurely 3- or more-lobed, the margins dentate-crenate; petioles 3-4 in. long and shorter above; stipules triquetrous or broadly ovate, usually connate: peduncles long and borne opposite the lvs., 5-10-fl.; fls. pedicelled, white or whitish; calyx more or less pubescent, the spur $\frac{1}{2}$ in. or less long, the sepals or lobes lanceolate, acute, with membranaceous margins; petals twice or less longer than calyx-lobes, about $\frac{1}{2}$ in. long, linear-spatulate, rounded at apex.—



2845. *Domesticum pelargonium*. One of the Show or Lady Washington pelargoniums ($\times \frac{1}{2}$). No. 21.

Apparently a common plant, cult. for its pleasant-scented foliage. The plant known to gardeners as *P. fragrans* is either this species or a close derivative from it. Harvey refers *P. fragrans*, Willd., to *P. exstipulatum*; but Knuth separates it as follows:

16. *fragrans*, Willd. (*P. odoratissimum* × *P. exstipulatum*, Sweet. *Geranium fragrans*, Poir. *G. odoratissimum erectum*, Andr.). Plant strict, the branches more or less erect: scarcely suffruticose, the sts. more or less squarrose-branched, leafy: lf.-blade to 1 in. long and nearly as wide, obtuse-cordate, the margin crenate or crisped, pubescent, the upper lvs. sessile and the lower long-petioled; stipules triquetrous, free: fls. nearly sessile, whitish, and more or less red-veined; calyx pubescent, the spur $\frac{1}{4}$ – $\frac{1}{2}$ in. long; sepals or calyx-lobes lanceolate or ovate-lanceolate, acute; petals twice or more longer than calyx-lobes, about $\frac{1}{2}$ in. long, much narrowed at base, the apex rounded.

AAAAAA. Plant woody, not succulent, much branched, the foliage often scented but not "fishy;" lvs. various, but not pinnately parted: infl. paniculate or umbel-like; 2 upper petals longer and broader than the others, marked; good stamens 7 or 6. (*Pelargium*.)

B. Lvs. not distinctly lobed, though often angled, mostly oval or ovate and cordate (exceptions in *P. domesticum*).

17. *betulinum*, Ait. (*Geranium betulinum*, Linn.). Erect and shrubby, downy on the young growths: lvs. subglabrous, stalked, oval or ovate, obtuse or not prominently acute, rounded or truncate at base, the stipules sharp and deciduous: fls. light purple, the broad upper petals with dark streaks; petals 2–3 times longer than lanceolate sepals, nearly equal, 1 in. or more long, cuneate-obovate, rounded and entire at apex. B.M. 148.—A handsome and neat plant.

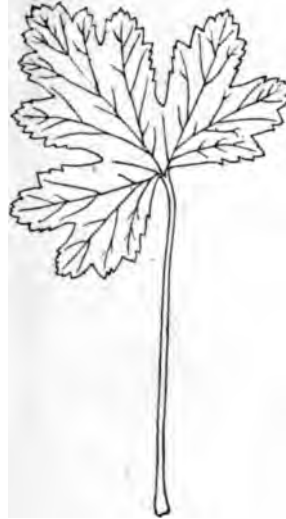
18. *cordatum*, L'Her. Figs. 2842, 2843. Shrubby and erect, villous or nearly glabrous: lvs. long-stalked, cordate-acute, denticulate and sometimes obscurely lobed; stipules with broad base but subulate, deciduous: peduncles usually branched, the pedicels and calyx soft-hairy; fls. purplish, the petals twice as long as the sepals, the two larger nearly or quite 1 in. long, cuneate-obovate, the apex rounded and entire. B.M. 165 (as *P. cordifolium*). G.M. 54:627.—Distinguished from *P. cucullatum* by its flat cordate acute lvs. It is a handsome plant in bloom. The plant in cult. as *P. cordatum*



2846. *Pelargonium quercifolium*. Leaves often more deeply lobed ($\times \frac{1}{4}$). No. 25.

(Fig. 2843), has lvs. more truncate at the base than the descriptions and old pictures call for, although on some shoots the lvs. may be typically cordate. In the wild, the plant runs into several forms, distinguished largely by pubescence.

19. *cucullatum*, Ait. (*Geranium cucullatum*, Linn.). Tall and shrubby plant, much branched, softly and densely villous: lvs. long-stalked, kidney-shaped and cupped or cucullate, denticulate, very soft-pubescent, the stipules ovate-acute and withering: fls. red or reddish, in many-fl. panicles, the pedicels and calices densely silky-hairy, the petals twice as long as the lance-acuminate



2847. Forms of leaf of *Pelargonium graveolens* ($\times \frac{1}{4}$). No. 26.

sepals, the two larger ones about 1 in. long and $\frac{1}{2}$ in. broad, rounded or retuse at apex, red with darker veins. —"Very common round Capetown and in the western districts, where it is often used as an ornamental hedge-plant."—Harvey. Known in England from 1690, and the parent, with *P. angulosum* and probably others, of the fancy or show pelargoniums of gardeners. Probably not known in cult. in its pure or original form.

20. *angulosum*, Ait. (*Geranium angulosum*, Mill.). Fig. 2844. Differs from *P. cucullatum* in its harsh-hairy covering and rigid angled lvs.: the lvs. are short-stalked, truncate or broadly cuneate at base, with 3–5 shallow angular and acute short rigid lobes: panicles with fewer-fl. umbels; pedicels and calices densely rough-hairy; petals twice as long as the acuminate sepals.—Linnæus included this plant in his *Geranium cucullatum*, but Aiton separated it as a distinct species. Linnæus' *cucullatum* was founded on literature. One of his sources of information was Dillenius' "Hortus Elthamensis," with a picture; but this picture, which is reduced in Fig. 2844, is what is now known as *P. angulosum*. This is one of the species which has entered largely into the pelargoniums of florists. Has been cult. since 1724.

21. *domesticum* class. COMMON, SHOW, FANCY, and LADY WASHINGTON GERANIUMS (OR PELARGONIUMS). Fig. 2845. This name distinguishes the garden type of florist's and fancy pelargonium. The race is said to be derived chiefly from *P. cucullatum*, *P. angulosum*, and *P. grandiflorum*, but the writer can see little evidence of the blood of *P. grandiflorum*. It seems to be nearest to *P. cucullatum*, having the cucullate or disk-shaped not lobed lvs. and mostly the soft-hairiness of that species. In many of them, however, the lvs. are distinctly angle-lobed, suggesting *P. angulosum*. *P. domesticum* is meant to comprise the whole range of garden forms of the Show or Lady Washington pelargoniums. The name will enable one to talk about these garden plants with precision. To many of these garden forms specific botanical names have been given, so that

P. domesticum is not the first name that has been applied in this group, but the writer is not aware that any collective or group name has been given. Sweet, in particular, has given Latin names to various forms. These old names, however, apply to particular historical forms, and it would be violence to enlarge their application to cover the entire group, and it would be difficult to choose any one of them as more applicable, under botanical rules, than others. It is probably also inaccurate to call this garden form either *P. cucullatum* or *P. angulosum*.



2848. *Pelargonium Radula*.
($\times \frac{1}{2}$)

on both surfaces; stipules ovate-acuminate, withering: fls. small, white, with red near the center, in a lax panicle, the pedicels many times longer than calyx-tube; 3 lower petals longer than sepals. B.M. 518.—Scent like peppermint, and for that reason it is somewhat grown. The sts. are long and straggly.

BBB. *Lvs. sharply 3-7-lobed and sharply toothed or serrate.*

23. *capitatum*, Ait. (*P. Drummondii*, Turcz. *Geranium capitatum*, Linn.). Sts. weak and trailing, but suffrutescent at base, with long white hairs: lvs. long-stalked, cordate, 3-5-lobed and the lobe rounded and toothed; stipules broad-cordate, pointed: peduncles longer than the lvs., densely many-fld., the fls. sessile, rose-purple, with calyx-tube much shorter than the hairy mucronate calyx-lobes. B.M. 7346.—Plant rose-scented, but not in general cult. in its pure form; fls. in dense many-fld. heads.

24. *vitifolium*, Ait. (*Geranium vitifolium*, Linn.). Erect, more or less woody, densely hairy and villous: lvs. long-petioled, cordate at base, 3-lobed, the lobes shallow and very obtuse and rounded, dentate; stipules broad-cordate: peduncle longer than lf., simple and densely many-fld.; fls. sessile, small, purple; calyx-tube not half so long as the hairy aristate segms.; petals twice longer than sepals, 2 of them larger and purple at base and the other 3 smaller and unicolorous.—Differs from *P. cordatum* in erect habit and lvs. less deeply cut.

BBBB. *Lvs. deeply several to many-lobed, with narrow divisions, rather rough or stiff, strong-scented.* ROSE GERANIUMS.

25. *quercifolium*, Ait. (*Geranium quercifolium*, Linn. f.). OAK-LEAVED GERANIUM. SCARLET-FLOWERING ROSE GERANIUM. Fig. 2846. Shrubby and branchy, somewhat hairy and glandular: lvs. with stalks 2-4 in. long, cordate-ovate in outline, with 2-3 pairs of oblong side lobes (lvs. pinnatifid), which extend nearly to the midrib and are again toothed and notched; stipules small, 2 pairs at each node (or bifid): fls. few to several, rather small, red or purplish, in umbels and with short

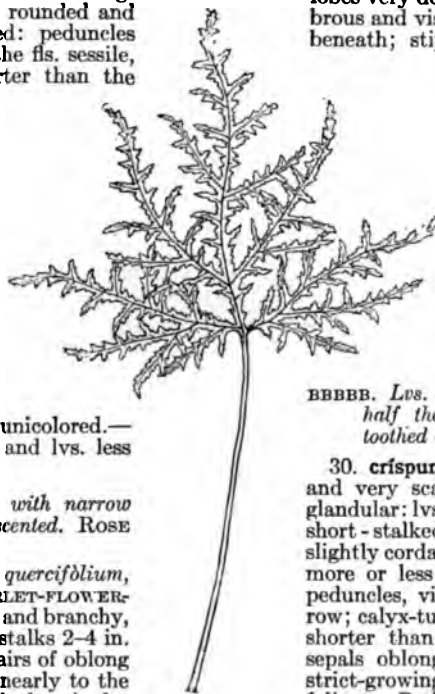
pedicels, the bracts lacinate; sepals elliptical and mucronate, half as long as the petals.—A rather common greenhouse plant, the lvs. often with a dark spot, and not agreeably scented.

26. *graveolens*, L'Her. (*Geranium graveolens*, Thunb.). Fig. 2847. Much like the last, but lvs. longer-petioled and palmately 5-7-lobed or parted, the broad lobes flat and pinnatifid into many mostly obtuse lobes; stipules cordate-acute: fls. many, on mostly long peduncles, pink or light purple, small, the calyx hairy and nearly sessile, the calyx-lobes half as long as the petals.—This is one of the commonest forms of rose geranium, a leafy plant with a rather heavy balsamic odor. A lf. is well depicted in Fig. 2847. There are many derivatives from it.

27. *hispidum*, Willd. (*Geranium hispidum*, Linn. f.). Woody at base but herbaceous upward, 2-3 ft., much branched, hairy and glandular: lvs. long-stalked, hispid on both surfaces, 4-5 in. across, 5-7-lobed, the lobes acuminate and unequally sharp-toothed and more or less lobulate; stipules cuspidate: fls. panicle, small, white to carmine; calyx-tube shorter than pedicels, the segms. lance-acuminate; petals about twice longer than sepals.—An old cult. plant.

28. *Rádula*, L'Her. (*P. multifidum*, Salisb. *Geranium Rádula*, Cav. *G. revolutum*, Jacq. f.). Fig. 2848. Differs from *P. graveolens* in the narrower divisions with revolute margins of the lvs.: the lvs. are deeply palmately parted, the lobes narrow linear and pinnatifid, all rough-hispid on the upper surface and soft-pubescent beneath: fls. small, pale purple, with dark streaks, the peduncles short and hispid and about 4-5-fld., fls. pedicellate; calyx-tube short, the lobes or sepals setose and glandular. B.M. 95.—Does not appear to be in the trade in a pure form, but the narrow-lobed rose geraniums are probably hybrids between this and *P. graveolens*.

29. *denticulatum*, Jacq. (*Geranium denticulatum*, Poir.). Fig. 2849. Much like *P. Radula*, but the fls. lobes very denticulate and flat: lvs. glabrous and viscid above, somewhat hispid beneath; stipules ovate-lanceolate: fls. 3-4, subsessile, on short hairy peduncles, lilac or rose-purple, the 2 upper petals toothed or 2-lobed and with dark streaks; calyx-tube short, the segms. or lobes oblong, mucronate and villous.—Plant weaker than *P. Radula*. It has a balsamic odor. Perhaps it has entered into the garden forms of rose geranium. Intro. into England in 1789.



2849. *Pelargonium denticulatum*.
($\times \frac{1}{2}$)

BBBBB. *Lvs. small, round-cordate, 3-lobed half their depth and the margins toothed or jagged.*

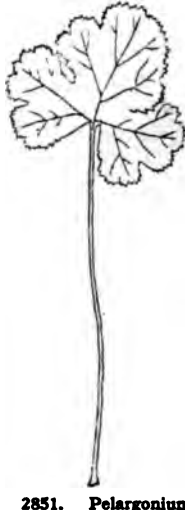
30. *crispum*, L'Her. Much branched and very scabrous or rough, shrubby, glandular: lvs. 2-ranked, small and rigid, short-stalked, cuneate, truncate or slightly cordate at base, coarsely toothed, more or less 3-lobed: fls. 2-3 on short peduncles, violet, the lower petals narrow; calyx-tube glandular and roughish, shorter than the pedicels, the lobes or sepals oblong and acuminate.—A neat strict-growing plant with lemon-scented foliage. Probably not in general cult. now in a pure form. Variable in the wild. Var. *latifolium*, Harv., Figs. 2850,

2851, has lvs. twice the size of the type, and is a worthy plant.

31. *Limòneum*, Sweet. LEMON GERANIUM. Lvs. larger than in the last, not 2-ranked, soft: fls. purple and lilac.—A garden hybrid, *P. crispum* probably being one of its parents. There is a form with variegated lvs. Sometimes known to gardeners as *P. odoratum*. It is a neat and worthy plant, and showy when in flower. It has a lemon or balm scent. The variety known as Lady Mary is of this group.



2850. *Pelargonium crispum* var. *latifolium*. (×¼)



2851. *Pelargonium crispum* var. *latifolium*. A lower leaf. (×¼)

Any number of Latin-formed names of *Pelargonium* may appear in the trade, for the hybrids and varieties are numerous and not always readily referable to the species as forms or varieties.—*P. Blandfordianum*, Sweet (*P. graveolens* × *P. echinatum*). A good grower, shrubby, the branches roughish pubescent: lvs. flat, 7-lobed, the lower lobes deeply lobed again, all bluntly toothed, strong-scented: fls. white or pale bluish, the upper petals with 2 red spots. G.M. 54:626.—*P. brevipetalum*, N. E. Br.—*P. polycephalum*.—*P. Cotyledonis*, L'Her. Lvs. evergreen, at base of plant, cordate, 3 in. across, entire or nearly so, whitish beneath, wrinkled above: fls. on scape-like peduncles above the lvs., ¼ in. across, white. St. Helena. Requires little heat. G. 35:235.—*P. inaequilobum*, Mast. Allied to *P. multibracteatum*. Pilose: lvs. 3-lobed, the terminal lobe ovate-lanceolate and again lobed in middle, margins toothed: fls. greenish yellow with purple in base. Trop. Afr. Perhaps same as *P. Fischeri*, Engl.—*P. luteolum*, N. E. Br. A very recent species from S. Afr.: herb with bulbous rootstock: lvs. 4 or 5, all radical, twice ternately divided, ¼–1½ in. long and broad, the ultimate segms. linear: petals nearly ½ in. long, pale yellow with 2 red lines at base.—*P. polyccephalum*, E. Mey. (*P. brevipetalum*, N. E. Br.). St. thick and fleshy, ovoid, rising very little above the ground, short-branched at top: lvs. in a rosette, bipinnately divided, ovate-oblong in outline, thick and fleshy: pinnae 5 or 6 pairs, pinnatisect: fls. pale yellow, the petals shorter than sepals. Cape Colony.—*P. roseum*, Hort., is a name of no botanical standing, applied to some of the common forms of rose geranium of the *P. Radula* group.

L. H. B.

PELECYPHORA (Greek, *hatchet-bearing*; from an alleged resemblance in the tubercles). *Cactaceae*. HATCHET CACTUS. Two species closely allied to *Mammillaria*; sometimes seen in cactus collections.

Stems globular, short-cylindric or clavate, small, often cespitose: tubercles strongly compressed from the sides; areoles very long and narrow, bordered on each side by a row of about 20 very short, appressed comb-like spines: fr. naked.

aselliformis, Ehrh. (from a fancied resemblance to *Asellus*, the wood-louse). Juice watery: tubercles ashy green, more or less deeply grooved to the woolly axil; spines not projecting beyond the margin of areole: fls.

purple with paler sepals: fr. near the center, red. Nuevo Leon and San Luis Potosi, Mex. I.H. 5:186. Var. *concolor* has pure purple fls. B.M. 6061.

pectinata, Schum. Juice milky: tubercles bright green with naked axils; spines projecting a little beyond the margin of tubercle: fls. yellow, lateral. Oaxaca, Mex.

KATHARINE BRANDEGEE.

PELIOSÁNTHEs (Greek, *livid flowers*, referring to the flowers of certain species). *Liliaceae*. Plants with short horizontal rhizomes, long-petioled radical lvs. and fls. borne in spikes or simple racemes: perianth-tube above the ovary, short, broad, campanulate; limb spreading-rotate with 6 subequal, broad, obtuse lobes; stamens 6 with very short filaments; ovary inferior, 3-celled; stigma 3-lobed; cells with 2 ovules erect from the base, anatropous; seeds oblong or globose, fleshy. About 12 species from India, the E. Indies, and Malayan Peninsula. The following have occasionally appeared in cult: *P. Teta*, Andr. Lvs. 2–7; petiole variable in length: scape naked or with a few scales above and large membranous sheaths at the base; raceme 6–12 in.; bracts 1–3 to every fascicle of fls., pedicels short; fls. ¼–½ in. diam., purplish or bluish green: seeds as large as a pea, olive-blue. Himalaya, Malaya. B.M. 1302. The var. *Mantegazziana*, Pampanini, is a form with less rigid lvs. than the type. Malaya. *P. violacea*, Wall., has the habit of *P. Teta* and fls. of the same size and color but solitary in the bracts: seeds ½ in. long, oblong. Himalaya, Burma. Var. *Clarkei*, Baker, differs from the type in having more conspicuous transverse nervules and a darker purple fl. Assam and Malaya. B.M. 8276. Cult. in botanic gardens in the tropical house.

F. TRACY HUBBARD.

PELLÆA (Greek, *pellos*, dusky; from the usually dark-colored leaf-stalks). *Polypodiaceae*. Small rock-loving ferns thriving best on limestone rocks.

Sori at the ends of free veins forming a mostly continuous marginal band around the segms. and covered by the more or less changed margin of the segms. The species are perhaps 40 or more, widely scattered in many countries. Some of them are glasshouse subjects and others are hardy.

A. Lvs. simply pinnate.

B. Lfts. 4–5 pairs.

Pringlei, Dav. Lvs. with 4–5 pairs of large triangular hastate stalked lfts. 1 in. or more across either way: sorus forming a wide marginal band. Mex.

BB. Lfts. 5–8 pairs.

Bridgesii, Hook. (*Platydoma Bridgesii*, J. Smith). Lfts. subsessile, orbicular or subcordate, 4–5 lines long: sori confluent in a broad intramarginal band. Calif.

BBB. Lfts. 20–40.

rotundifolia, Hook. Fig. 2852. Lfts. mostly short-stalked, oblong or roundish, entire, obtuse. New Zeal.

falcata, Fée (*Platydoma falcatum*, J. Smith). Lfts. nearly sessile, lanceolate or lanceolate-oblong, mucronate and often slightly falcate: sori in broad lines. India to Austral. and New Zeal.



2852. *Pellaea rotundifolia*. (×½)

AA. *Lvs. bipinnate.*

B. *Pinnæ formed of 3 sessile lfts.*

ternifolia, Link. Lvs. 6-12 in. long on strong dark chestnut stalks, narrow, with 6-12 opposite pairs of pinnæ; lfts. closely rolled together, linear. Trop. Amer.

BB. *Pinnæ (at least the lower ones) of more than 3 lfts.*
mucronata, Eaton (*P. Wrightiana*, Hook.). Lvs. 3-6 in. long, 1-3 in. wide, deltoid; pinnæ with several linear-oblong pinnules on each side $\frac{1}{4}$ in. long, with inrolled edges and a sharp mucronate point. Texas to Calif.

atropurpurea, Link. Lvs. 4-12 in. long, 2-6 in. wide, lanceolate to ovate-lanceolate, with several pinnules which are sessile, auricled or heart-shaped at the base, the broad line of sporangia nearly hiding the narrow marginal indusium. E. Amer., to the Rocky Mts.



2853. *Pellaea viridis*. A good greenhouse fern, likely to be known to gardeners as *P. hastata*.

AAA. *Lvs. at least tripinnatifid.*

B. *The lvs. triangular-deltoid, with narrow ultimate divisions.*

densa, Hook. CLIFF BRAKE. Lvs. 2-3 in. long, 1-1½ in. wide, on slender brown stalks; segms. linear with inrolled edges sharp-pointed; indusium permanently covering the sori. Pacific N. Amer., and eastward to Wyo.

BB. *The lvs. elongate, ovate, or lanceolate.*

andromedæfolia, Fée. Lvs. 6-12 in. long, 3-6 in. wide; ultimate divisions 1½-2 lines long, linear-oblong, with inrolled edges. Calif.—Sometimes known as the coffee fern.

viridis, Prantl (*P. hastata*, Link). Fig. 2853. Lvs. 6-24 in. long, 6-12 in. wide; ultimate divisions ovate or lanceolate, 1-2 in. long, nearly sessile; sori in a narrow marginal line. E. and S. Afr. Small lvs. are sometimes only bipinnate. Very commonly used in small ferneries.

P. Stelleri, Beddome (*P. gracilis*, Hook.), a rare membranous species of the eastern states, is more closely allied to the genus *Cryptogramma*, to which Prantl has referred it.

L. M. UNDERWOOD.

PELLIÖNIA (J. Alphonse Pellion, officer in Freycinet's voyage around the world). *Urticaceæ*. Two choice tender creeping foliage plants of this genus are cultivated, suitable for baskets and for the borders of greenhouses under the benches.

Herbs, often creepers, rarely subshrubs from Trop. and E. Asia and the Pacific Isls.: lvs. alternate, 2-ranked, unequal at the base, entire or serrate; fls. monœcious or dioecious, mostly in dense cymes; perianth-segms. 5, rarely 4, in fr. sometimes unchanged but usually increased and investing the fr. —Species 15-20. The cult. species require warm temperature and moist atmosphere. Prop. by cuttings and division. One of the species was once advertised as a *Peperomia*.

Daveauana, N. E. Br. Prostrate, 1-2 ft. long, the sts. succulent and creeping below, the tips pubescent: lvs. 1-2½ in. long, sessile, obliquely oblong or orbicular, crenate and obtuse at tip, dark bronzy olive-green more or less flushed violet or red, with a fern-like figure of light green down the middle of the lf., the figure being narrowly oblong and crenate. This figure is sometimes absent from some of the lvs. The lvs. are more acuminate than in the next. Burma to Cochin-China. R.H. 1880:290 (as *Begonia Daveauana*, a charming picture). I.H. 29:472.

pulchra, N. E. Br. Practically glabrous, with creeping fleshy sts. tinged purplish: lvs. obliquely oblong and very obtuse, dull blackish along the midrib and veins, the inter-spaces being light green, the under surface pale purplish. Cochin-China. I.H. 30:479. A.G. 15:4.

WILHELM MILLER.

L. H. B.†

PELORIA (Greek for *monster*). A term applied to the phenomenon when usually irregular flowers, such

as those with some of the petals or sepals spurred or saccate, develop all the parts of each set alike, thus becoming radially symmetrical. The case was observed by Linnæus in *Linaria vulgaris*, Fig. 2854, and the term peloria was given by him. Flowers often become peloric on account of changes in their relations to light, but other causes certainly contribute. A reverse change, by which radial flowers become zygomorphic, occurs in many *Compositæ* when the corollas of disk-florets become strap-shaped, as in the cultivated asters and chrysanthemums. Sometimes, on the contrary, all spurs fail to develop.



2854. Toad-flax—*Linaria*. Showing normal flowers above and an abnormal or peloric flower beneath.



2855. Normal columbine flower, with spurs present.

(Figs. 2855, 2856.) Peloric forms have been of little significance in horticulture. See Keeble, Pellew and Jones on inheritance of peloria in foxgloves, "New Phytologist," Vol. IX, page 68 (1910).

PELTÁNDRA (Greek, referring to the peltate anthers). *Araceæ*. **ARROW ARUM**. Stemless herbs, being excellent subaquatic plants, their large thick sagittate leaves always adding variety and interest to margins of ponds and to bog-gardens.

Leaves glossy, arrow-shaped, arising from strong underground parts: fls. monœcious and naked, the staminate ones on the upper part of the long spadix, the anthers sessile and imbedded and opening by terminal pores, the 1-loculed ovaries attended by 4 or 5 scale-like bodies or staminodia: spathe usually exceeding the spadix: fr. a 1-3-seeded, mostly leathery berry, borne in large globose clusters. —Two species in E. Amer. which have been much confused. Single specimens or clumps are usually most prized. Peltandras are easy to colonize.

virginica, Kunth (*P. undulata*, Raf.). Lvs. narrow-sagittate, the basal lobes long and nearly or quite acute: spathe 4-8 in. long, green, convolute around the spadix for its whole length; sterile part of the spadix much longer than the pistillate part: fr. green, 1-3-seeded. In shallow pools or bog margins, New England to Fla. and west. A.G. 14:111. —The root is composed of thick cords or fibers.

sagittæfolia, Morong (*P. alba*, Raf.). Lvs. broader the basal lobes short: spathe white, the upper part expanded and calla-like; sterile part of spadix little, if any, longer than pistillate part: fr. red, 1-seeded. Va., south. —Root tuberous.

L. H. B.

PELTÁRIA (Greek, *small shield*, referring to the roundish form of the pod). *Cruciferae*. Tall glabrous herbs with entire cauline lvs., sagittate-cordate at base: fls. white, subcorymbose; fruiting pedicels spreading or recurved, filiform, without bracts; sepals broad; stamens free, not toothed: silique orbiculate or obovate, 1-celled, indehiscent, much compressed, reticulate. About 4 species, natives of S. Eu., Asia Minor, Syria, and Persia. *P. alliacea*, Jacq. About 1 ft. high, with entire petals, smooth flat pods, and sagittate-clasping lvs. This species has the odor of garlic, as its name would suggest. E. Eu. Offered in the trade as a cut-fl. R.H. 1908, p. 131.

PELTIPHÝLLUM: *Saxifraga*.

PELTÓPHORUM (Greek, *shield and bearing*, referring to the peculiar stigma). *Leguminosæ*. A few species of splendid tropical trees, belonging to the same tribe as the gorgeous Poinciana and Cæsalpinia.

Flowers yellow; petals 5, roundish; stamens 10, free, declinate; filaments pilose at base; ovary sessile, 2- to many-ovuled: pod flattish, indehiscent, with narrowly winged margins. Peltophorum is distinguished from



2856. *Peltaria*. —Lack of spurs in the columbine. (Compare Fig. 2855.)

PENNISETUM

Cæsalpinia and *Poinciana* by the valvate calyx-segms. of the latter, while the two former have their calyx-segms. strongly imbricated. The peculiar stigma of *Peltophorum* readily distinguishes it from its close allies, *Cæsalpinia* and *Hæmatoxylon* (logwood). These genera represent a type of structure widely different from the northern pea-shaped fls., as they have 5 distinct petals which are all about the same size and shape. There is a fine colored plate of a *Peltophorum* in Blanco's "Flora of the Philippines," where the golden fls. are nearly $1\frac{1}{2}$ in. across, a dozen of them in each raceme, and 4 racemes uniting to form a great panicle. *Peltophorums* have the *Mimosa* type of foliage. Each lf. of *P. inerme* has 8-10 pairs of pinnae, and each pinna 10-20 pairs of lfts. The generic name is pre-occupied by *Peltophorus*, a genus of grasses, and is consequently replaced by some recent authors by the name *Baryxylum*.

A. Lfts. $\frac{1}{2}$ - $\frac{3}{4}$ in. long, 10-20-pinnate.

inerme, Naves (*Cæsalpinia inerme*, Roxbg. *P. ferugineum*, Benth. *Baryxylum inerme*, Pierre). Tree, attaining 100 ft., taking its specific name from the dense rusty tomentum which covers the young branches, petioles, and infl.: lvs. 8-10-pinnate, oblong, obtuse or retuse, oblique at the base, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, shining above, rusty tomentose beneath: racemes 5-6 in. long, in a large terminal panicle; calyx about $\frac{1}{2}$ in. long; petals obovate, undulate, villous at the base: pod 3-4 in. long, $\frac{1}{4}$ -1 in. wide, 1-3-seeded. Austral., Philippines. —Intro. at Santa Barbara, Calif., by Franceschi, but has not been a success there.

AA. Lfts. $\frac{1}{4}$ - $\frac{1}{2}$ in. long, 20-30-pinnate.

dubium, Taub. (*Cæsalpinia dubia*, Spreng. *P. Vogelianum*, Walp. *Baryxylum dubium*, Pierre). A large beautiful tree with rusty tomentose branches, petioles, and infl.: lvs. 9-18 in. long, 12-20-pinnate, 2-4 in. broad; lfts. 20-30-pinnate, oblique, oblong, obtuse, symmetrical or base unequal, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, minutely rusty tomentose beneath, becoming glabrate: infl. a broad terminal panicle; fls. in simple or branched racemes; pedicels $\frac{1}{4}$ - $\frac{1}{2}$ in. long; calyx-tube very short, turbinate; petals broadly obovate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, margin wrinkled; very short-stalked, rusty tomentose: pod 3 in. long, $\frac{3}{4}$ in. broad, acute at both ends, 2-seeded. Brazil.

P. L. RICKER.

PENIOCEREUS (Latin combination, meaning *phal-loid Cereus*). *Cactaceæ*. Low slender erect plants, growing from very large fleshy turnip-shaped roots: sts. usually 4- or 5-ribbed: fls. large, nocturnal, usually white: fr. ovoid, long-acuminate, bright scarlet, edible.

Gréggii, Brit. & Rose (*Cereus Gréggii*, Engelm.). Slender, branching, 2-3 ft. high, $\frac{1}{4}$ -1 in. diam., from an extraordinarily large tuberous root (often 6-10 in. long and 4-6 in. diam.): ribs 3-6, acute; spines subulate from bulbous base, very short and sharp, 7-11, 1 or 2 being central: fls. white or yellowish, 6-8 in. long: fr. ovate, alternate at base and apex, bright scarlet, fleshy and edible, 1-2 in. long. Borders of Texas, New Mex., Ariz., and southward.

J. N. ROSE.

PENNISETUM (Latin, *penna*, feather; *sela*, bristle). *Gramineæ*. Mostly stout grasses with bristly spike-like inflorescence, making conspicuous border and lawn plants.

Spikelets as in *Panicum*, but surrounded by several bristles that fall with the spikelet. —Species about 40 in tropical regions, one species cult. for fodder, some of the others for ornament.

The plummy grass known to gardeners as *P. longistylum* is much used for bedding. It is, perhaps, the finest dwarf grass which is grown chiefly for its flower parts. It sometimes survives the winter at Washington, D. C., but should always be treated as a tender

subject. Plants raised every year from seed are satisfactory if seed is sown early enough, but divisions of old plants will give larger pieces which flower sooner and require less attention than seedlings. The old plants may be wintered anywhere out of reach of frost. About February 1, in the latitude of Washington (a month later North), cut off the old leaves to within 6 inches of the crowns; divide the clumps into small pieces, trim the roots so that they will ultimately go into 3- or 4-inch pots, and place the pieces thickly together in boxes of sandy soil in a greenhouse with a temperature of about 60°. As soon as new roots have started, pot the young plants. They may be removed to a coldframe long before the soft bedding material demands all the available indoor space. (G. W. Oliver.)

A. Annual: bristles about as long as the spikelet.

americanum, Schum. (*Penicillaria spicata*, Willd. *Pennisetum typholdeum*, Rich.). PEARL MILLET. Culm 3-8 ft., pubescent below the spike: lvs. long and broad: spike cylindrical, 3-10 in. long, $\frac{3}{4}$ in. thick, the globose grain bursting through its lemma and palea. Native country unknown.—Occasionally grown in the southern states, where it ripens seed. May be grown farther north for forage. A luxuriant annual, long cult. in the Old World for forage and more or less for the grain which is used as food.

AA. Perennials: bristles much exceeding the spikelet.

B. Bristles plumose.

villosum, Brown (*P. longistylum* of florists, not of Hochst.). Fig. 2857. Spike broad, 2-4 in. long, and feathery from the bearded bristles; culm 1-2 ft. high, pubescent below the spike. Abyssinia. R.H. 1890, p. 489.

Ruppelii, Steud. (*P. Ruppelianum* of some works). Fig. 2858. Culms taller and spikes 6-10 in., longer and



2857. *Pennisetum villosum*.

more graceful than the preceding. Abyssinia. R.H. 1897, pp. 54, 55. I.H. 42, p. 206. G.W. 1:363.—The form most frequently cult. has a pale roseate spike. This is sold under the names *P. atrosanguineum*, *P. hybridum Henkelianum*, or CRIMSON FOUNTAIN GRASS. G.W. 13:255. R.B. 36, p. 58.—A half-hardy form with



2858. *Pennisetum Ruppelii*.

dark purplish foliage and purplish crimson spikes has recently been intro. under the name of *P. cupreum*. It does not reproduce reliably from seed.

BB. Bristles naked.

C. Spikes several on each main culm, borne on short branches; one bristle in each cluster much longer than the others.

latifolium, Spreng. (*Gymnóthrix latifolia*, Schult.). Culm 3-4 ft., bearing several nodding spikes 1-2 in. long: lvs. lanceolate, $\frac{1}{2}$ in. broad. Argentina. R.H. 1890, p. 546. G.W. 3, p. 424; 6, p. 113.

CC. Spikes single, terminating each main culm; bristles more or less equal.

japonicum, Trin. (*P. compressum*, R. Br. *Gymnóthrix japonica*, Kunth). Culm 2-3 ft., scabrous, especially under the dense cylindrical 2-3-in.-long spike: blades long and narrow. China.

macrothrum, Trin. (*Gymnóthrix caudata*, Schrad.). Culms tall, bearing a slender spike as much as a foot long. S. Afr.

macrostachyum, Trin. (*Gymnóthrix macrostachys*, Brongn.). Culms 4-5 ft., blades broad, flat; spike 8-12 in., resembling that of *P. Ruppelii*. E. Indies.—A half-hardy form with dark purplish foliage and handsome dark crimson spikes has recently been intro. under the name of *P. macrophyllum atropurpureum*. M.D.G. 1906:9. Does not reproduce reliably from seed.

nervosum, Trin. Tall branching perennial with tawny or purplish compact spikes is offered by a western nursery. S. Amer.

A. S. HITCHCOCK.

PENNYROYAL of Europe, *Mentha Pulegium*; of America, *Hedeoma pulegioides*. Bastard P., or blue curls, is *Trichostema dichotomum*. All are members of the mint family.

The garden pennyroyal, *Mentha Pulegium*, is a European perennial, used for seasoning. It is one of the

"sweet herbs." It is easily grown, profiting by a winter protection of leaves or litter. Propagation is mostly by division. Beds should be renewed frequently.

PENTACHÆTA (Greek, referring to five bristles at the base of the pappus). *Compositæ*. A few species of low slender Californian annuals with thread-like alternate lvs. and small or medium-sized heads, the rays when present usually yellow, sometimes white: the disk-fls. sometimes turning purple. *P. aurea*, Nutt., growing 3-12 in. high and with 7-40 deep golden rays, was once offered and was pictured in Gt. 33:1153, but it has no horticultural standing.

PENTÁPETES (Greek, *having five leaves*; an ancient name of some cinquefoil, transferred by Linnaeus to this plant, which has five leafy growths (staminodes) accompanying the stamens; or perhaps to the 5-merous arrangement). *Sterculiæ*. A pretty red-flowered tender annual, widely distributed in tropical Asia, rare in gardens.

Species one, *P. phœnicea*, Linn. Erect branched herb, nearly or quite glabrous, 3-5 ft.: lvs. 3-5 in. long, hastate-lanceolate, 1-nerved, crenate-serrate; petiole 1 in. long; stipules awl-shaped: fls. red, about 1½ in. across, opening at noon and closing early following morning; bractlets 3, caducous; sepals 5, lanceolate, connate at the base; petals 5; stamens 20, connate at the base, 15 fertile in 5 groups of 3 each, alternating with 5 staminodes which are nearly as long as the petals; ovary 5-celled; cells many-ovuled: caps. loculicidally 5-valved; seeds 8-12, in 2 series in each cell. B.R. 575.—An interesting plant for amateurs in the warmhouse or for cult. in the open in summer. Prop. by seeds and cuttings.

L. H. B.

PENTAPTERYGIIUM (Greek words, *five* and *a small wing*; alluding to the five-winged calyx). *Eriodæ*. Epiphytic shrubs, glabrous or strigose-hirsute, with alternate subsessile lvs., rather large and scattered or small and sub-distichously clustered: fls. rather large, axillary, solitary or in few-fl. corymbs; calyx-tube turbinate or hemispherical, 5-winged; limb of 5 persistent leafy lobes; corolla tubular, 5-angled, with a limb of 5 suberect or recurved lobes; stamens 10; ovary 5-celled. About 6 species, 1 from the Malay Peninsula, the remainder from the temperate Himalayan region. Two species have been occasionally in cult. *P. rugosum*, Hook. Fls. pendulous; corolla nearly white, beautifully marked between the 5 angles with purple or blood-red bands: lvs. almost sessile, subcordate at base, very much wrinkled, lanceolate or ovate-lanceolate. Khasia Mts. B.M. 5198. G. 36:617. G.W. 2, p. 502. *P. serpens*, Klotzsch. Fls. numerous, axillary, hanging along the under side of the branches; calyx green, 5-angled; corolla bright red, with darker V-shaped marking: lvs. small, lanceolate: sts. slender, drooping: rootstock large, tuberous. Himalayas. B.M. 6777. G.W. 13, p. 90.

PENTARHAPHIA (Greek, *five needles*, referring to the form of the open calyx). *Gesneriæ*. Shrubs or subshrubs, one or two of which are grown under glass for the fls. This genus is most commonly treated as a section of the genus *Gesneria*, but is considered distinct by some. The principal characters of the section are the relatively bare branches, the 1- to several-fl. elongated peduncles borne in the lf.-axils: fls. with a crooked cylindrical tube; stamens more or less long-exserted. At least 15 species, Mex., W. Indies, and S. Amer. *P. floribunda*, Carr. Much of the material cult. under this name is referable to *Gesneria libanensis* (Vol. III, p. 1333), but some of it may be other species, as there appears to be more than one plant passing under this name. R.H. 1878:30. B.M. 4380. R.B. 25:241. These portraits may not all represent the same plant.

PÉNTAS (Greek, *five*, referring to the floral parts) *Rubiæ*. Tender herbs and subshrubs, resembling bouvardias and of the same family, grown under glass for the lilac or white bloom.

Herbs or subshrubs, erect or prostrate, hispid or tomentose: lvs. opposite, stalked, usually ovate or ovate-lanceolate; stipules multifid or multi-setose: infl. usually corymbose; calyx-lobes 4-6, unequal; corolla pilose, the long tube dilated and villous in the throat; lobes valvate; stamens 4-6, inserted below the throat; filaments short or long; anthers fixed at the back, included or exserted; disk tumid or annular, often produced into a cone after anthesis; ovary 2-loculed; ovules numerous; style-branches papillose: caps. membranous or leathery, 2-loculed, loculicidal; seeds minute.—There are about 30 known species in Trop. and S. Afr., including Madagascar. Only one is well known in cult., whose color varieties range through lilac and flesh-color to crimson-pink and rosy purple. A good cluster is 3 in. across and contains 20 or more fls., each of which is ½ in. across. The fls. are about ¾ in. long, funnel-shaped, and usually have 5 spreading lobes, sometimes 4 or 6. It is mostly grown like bouvardia in warm conservatories for winter bloom, but it is sometimes used for bedding in warmer countries, as it gives 3 months of rather showy bloom when treated like lantana. In general, the species seem to be less worthy than bouvardias.

The pentas may be propagated from February to the middle of April. Choose cuttings of half-matured wood and place in a warm propagating-bed; by keeping moist and shaded they will root. Before they have made too long roots, lift and transfer into small pots. They like a sandy open mixture, as of loam, peat, and sand in equal parts for the first potting. Place where they may have shade until well started, when they should have sun. In their growing season, which is from the end of January until autumn, they should have a temperature of 60° to 65° at night with 10° to 15° rise during the day with sun. Keep the young plants vigorous by giving larger pots until they are in 6- to 8-inch pots. For a compost give them fibrous loam four parts, fibry peat one part, well-decayed cow-manure one part, and enough sand to keep it open. Always give plenty of drainage in the pots, and pot moderately firm. In the spring and summer they will require plenty of water. In the hot days of summer give daily syringing, getting well under the foliage. As they grow, tie the branches out horizontally; they then will break away into a number of growths which will make headway for flowers in autumn. If they show bloom before this time, pinch the flowers out. When the pots become well supplied with roots, give liquid feed once a week. The flowers are very useful for cutting. The care in winter should require a lower temperature; they do well in 55° to 58° at night, with about 10° more with sunshine. Give enough water to keep them in good health and a good syringing now and then. After January, they may have any necessary repotting, such as renewing the old compost with a good rich material and growing on as treated the preceding spring and summer with the exception of cutting back the shoots well. (J. J. M. Farrell.)

lanceolata, Schum. (*Ophiorrhiza lanceolata*, Forsk. *P. carnea*, Benth., under which name it is known to gardeners). Erect or decumbent, 1-2 ft. high, shrubby at base, merely puberulous, not rusty-hairy: lvs. 1-6 in. long, 4 lines to 2 in. broad, ovate, elliptic or lance-oblong, more or less acute, narrowed at base into a short petiole, the lateral veins many: cymes peduncled or not; fls. nearly sessile, to 1 in. long, dimorphic, naturally pale purple; corolla very hairy at throat. Trop. Afr., Arabia. B.M. 4086. B.R. 30:32. R.B. 21:217. Gn. 21, p. 329. J.H. III. 30:209; 52:417. G.W. 10, p. 378. Var. *kermesina*, Hort. Fls. carmine-rose, tinted violet in throat. R.H. 1870:130. Var. *alba*, Hort., has

white fls. G.W. 10, p. 611. Var. *Quartiniiana*, Hort. (*P. Quartiniiana*, Oliver) is a rosy-fl. variety said to be much better than the type. Gt. 45, p. 464.

WILHELM MILLER.
L. H. B.†

PENTLÁNDIA: *Urceolina*.

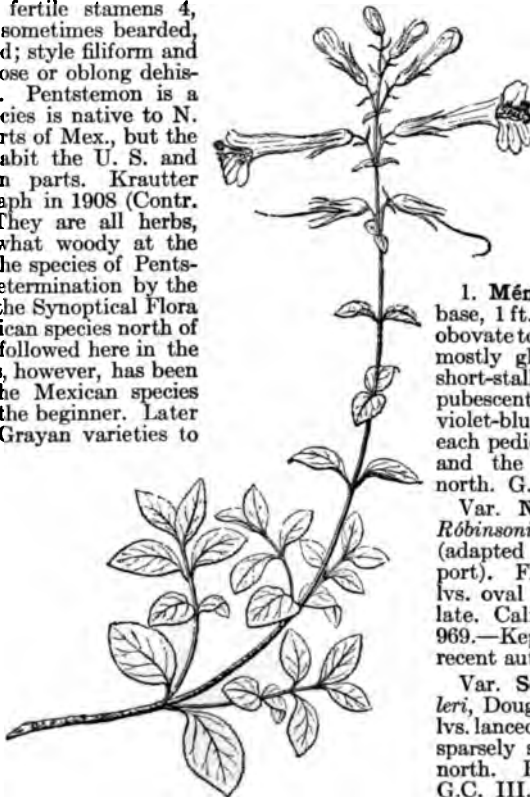
PENTSTEMON (Greek for *five stamens*, all five stamens being present, whereas related genera have only four; but in *Pentstemon* one of the stamens is sterile). Sometimes written *Pentastemon*. *Scrophulariaceae*. **PENTSTEMON**. BEARD-TONGUE. Tubular-flowered bedding and border plants, mostly of bright colors; many are natives in the United States.

Perennial herbs or shrubs of medium or small size, spring- and summer-blooming, glabrous or pubescent, the sts. mostly little branched: lvs. opposite or whorled, entire or toothed (the upper ones sometimes alternate): fls. in terminal racemes or thyrsoid clusters, mostly showy, blue, red, purple, white; calyx 5-parted, with imbricated segms.: corolla tubular, usually dilated at the throat, distinctly or obscurely 2-lipped, the upper lip 2-lobed or notched and the lower 3-lobed; fertile stamens 4, didynamous, the fifth sterile and sometimes bearded, all of them included or not exerted; style filiform and stigma capitate: fr. an ovoid, globose or oblong dehiscent caps., with numerous seeds. *Pentstemon* is a typical American genus. One species is native to N. E. Asia and many to the cooler parts of Mex., but the larger number of the species inhabit the U. S. and Canada, particularly the western parts. Krautter admits 148 species in his monograph in 1908 (Contr. Bot. Lab., Univ. of Pa. III). They are all herbs, although some species are somewhat woody at the base. It is difficult so to arrange the species of *Pentstemon* as to make them easy of determination by the horticulturist. Gray's account in the Synoptical Flora (Vol. 2, Part 1) describes the American species north of Mex.; and this account has been followed here in the main. The arrangement of species, however, has been modified considerably to admit the Mexican species and to make the group easier for the beginner. Later writers are inclined to raise the Grayan varieties to the rank of species.

For the hardy border, pentstemons are most satisfactory plants, and the great number of showy species allows much latitude in choice of color and habit. All are perennial, but some of them bloom the first year from seed. In a dry and hot place they are likely to be short-lived, although nearly all the species thrive best in full exposure to sun. They should have good deep garden soil. They are propagated by division and by seed, the latter usually being preferred. Many of the species are not hardy in the northern states, but *P. barbatus* and its varieties, *P. hirsutus*, *P. laevigatus* and variety, *P. confertus* and variety, *P. diffusus*, *P. ovatus*, *P. grandiflorus*, *P. acuminatus*, *P. angustifolius*, *P. glaber* and varieties, and also others, may be expected to stand in the North, particularly if given a protection of leaves. An excellent garden race has been produced, here designated as *P. gloxinoides*. This seems to be a product of hybridization and selection. It is little known in American gardens, although it is a handsome and deserving plant. Some of the forms of it are treated as annuals. Most of the species described in this account are not domesticated or modified plants, but are sold or distributed as stock secured more or less directly from the wild.

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2859. *Pentstemon Menziesii* var. *Newberryi*. By many authors considered to be a distinct species, and then known as *P. Newberryi*. ($\times \frac{1}{2}$)

A. Cells of anthers dehiscent for nearly or quite their whole length, united or connivent at the apex and soon spreading from each other. (Nos. 1-38.) Nos. 4, 10, 16 are in doubt as to position in key.

B. Anthers covered with long wool.

1. *Menziesii*, Hook. Woody at base, 1 ft. or less high: lvs. thick, obovate to oblong, serrate or entire, mostly glabrous, the lower ones short-stalked: cluster a raceme, pubescent; fls. 1 in. or more long, violet-blue to purple, usually 1 on each pedicel, the upper lip 2-cleft and the lower 2-cleft. Wash., north. G.M. 45:100.

Var. *Newberryi*, Gray (var. *Robinsonii*, Mast.). Fig. 2859 (adapted from Pacific R. R. Report). Fls. pink or rose-purple: lvs. oval or ovate-oblong, serrulate. Calif. to Wash. G.C. 1872: 969.—Kept specifically distinct by recent authors as *P. Newberryi*.

Var. *Scouleri*, Gray (*P. Scouleri*, Douglas). Fls. violet-purple: lvs. lanceolate to linear-lanceolate, sparsely serrulate. Wyo. to Ore., north. B.R. 1277. B.M. 6834. G.C. III. 7, p. 204. Gn. 52, p. 42; 70, p. 250. G. 36:23; 37:408.—Kept specifically distinct by some as *P. fruticulosus*, Greene (*Gerardia fruticosa*, Pursh). *P. fruticulosus*

var. *crassifolius*, Kraut. (*P. crassifolius*, Lindl. *P. Douglasii*, Hook.). Fls. lilac-purple, pink at base: lvs. oblong or obovate-lanceolate, entire. Ore., north. B.R. 24:16.

2. *Davidsonii*, Greene. An alpine dwarf, differing from *P. Menziesii* in having its tough and almost herbaceous branching sts. underground except the very short and erect flowering branches, and obovate and oval obtuse or acutish entire veinless lvs.: proper st. mainly subterranean and horizontal, rooting at joints; free branches 1-2 in. high, the fls. usually exceeding in size all the remainder of the plant above ground: corolla

1 in. long, lilac-purple, ventricose from near the tips of the sepals, the lobes rather short and not very unequal; stamens included, woolly. Discovered by George Davidson, on Mt. Conness, Calif., altitude 12,300 ft.; occurs on Mt. Shasta and north to Wash.—Offered abroad.

BB. *Anthers glabrous or only hairy (not woolly).*

c. *Plant semi-scandent (somewhat climbing) by means of long slender branches, or at least some of the branches long and weak or slender.*

3. *cordifolius*, Benth. Plant very leafy, somewhat pubescent, clambering over shrubs: lvs. ovate, often more or less cordate, serrate, 1 in. or less long: cluster or thyrses short and leafy, the peduncles several-fld.; corolla tubular, scarlet, the tube 1 in. long and the limb half as long. S. Calif. B.M. 4497. R.H. 1850:221. J.F. 1:14.



2860. *Pentstemon Hartwegii*. (× ¼)

4. *ternatus*, Torr. Flowering shoots 2–4 ft. long, virgate, glabrous and glaucous: lvs. linear-lanceolate, rigid, serrate or denticulate, the upper ones in 3's: fls. in a raceme-like thyrses, pale scarlet; calyx with ovate-acuminate parts; corolla 1 in. long, the lips ¼ in. long. S. Calif., in mountains.

cc. *Plant erect, self-supporting.*

d. *Fls. lemon-yellow to yellow-red.*

5. *antirrhinoides*, Benth. (*P. Lobbia*, Hort.). Plant 1–5 ft., glabrous or nearly so, branched and leafy: lvs. small, oval or spatulate, entire: fls. in leafy panicles, the peduncles 1-fld., the broad fls. about 1 in. long, the lower lip deeply 2-lobed; sterile filament bearded on one side. S. Calif. B.M. 6157. I.H. 9:315.

6. *Lémmonii*, Gray. Slender shrub, 5 ft. or less tall, bright green and glabrous: lvs. ovate-lanceolate, toothed: panicle loose and branchy, the long peduncles 2–7-fld.; fls. small, dull yellowish and red, the segms. nearly equal. Cent. Calif.

DD. *Fls. not yellow (unless sometimes in P. confertus), mostly in shades of red or purple, sometimes white.*

E. *St. and lvs. glabrous, at least up to the infl. (Nos. 7–34).*

F. *Corolla long and slender, not swollen near the base or greatly widened at the mouth: straight-fld. species.*

7. *barbatus*, Nutt. (*Chelone barbata*, Cav.). Tall, erect, branching, glabrous and more or less glaucous herb: lvs. firm, varying from lanceolate to linear, entire, strong-veined, the radical ones oblanceolate or spatulate: fl.-cluster long and open, narrow, the peduncles about 2–3-fld.; fls. slender, about 1 in. long in

wild forms, strongly 2-lipped, varying from light pink and flesh-color to carmine, the lower lip usually bearded. Colo., south. B.R. 116; 25:21. R.H. 1896, p. 347. G. 32:75. Mn. 7:141.—Showy perennial, common in cult.

Var. *Tórreyi*, Gray (*P. Tórreyi*, Benth.), is a scarlet-fld. form, with almost no beard on the lower lip; the commonest form of the species in cult. Hillsides, Utah, Colo., south and to Texas.—Excellent.

Var. *coccineus*, Hort., is a scarlet-fld. horticultural form.

8. *labræsus*, Hook. (*P. barbatus* var. *labræsus*, Gray). Much like *P. barbatus*, but narrower-lvd., the infl. almost simply racemose and the corolla more slender, light scarlet, not bearded, the limb longer; 3 lobes of lower lip linear, spreading, half the length of tube, equaling those of upper lip. Calif. and Low. Calif. B.M. 6738. G.C. II. 20:537.—A good perennial, 1–2 ft., making many sts.

9. *Eatonii*, Gray. Sts. 1–2 ft. high: lvs. lanceolate to ovate, the upper ones partly clasping: fls. bright carmine-red, in a simple and strict thyrses, the peduncles 1–3-fld.; calyx-lobes or sepals ovate-lanceolate; corolla 1 in. long, tubular, the throat naked and scarcely enlarged, the lobes broadly oval and all much alike; sterile filament sometimes minutely bearded. Utah, Nev., New Mex., Ariz., and S. Calif. B.R. 10:14. F.S. 3:232 (as *P. miniatus*).

10. *isophyllus*, Robs. St. somewhat decumbent at base, erect, 2 ft. or so high, simple, purplish, pulverulent, very leafy, with lvs. in nearly equal pairs: lvs. lanceolate, entire, thickish, glabrous, sessile, acute, margin revolute: fls. in a long secund panicle, nodding, scarlet; calyx deeply 5-parted; corolla about 1½ in. long, the 5-lobed limb erose-crenulate, the throat somewhat enlarged and more or less white-puberulent. Mex.

11. *triflorus*, Heller. Perhaps to be entered at this point: glabrous or nearly so to the infl., 2–3 ft.: lower lvs. spatulate or oblong, almost entire, with margined petioles; upper lvs. oblong to ovate: fls. rose-purple, the peduncles glandular-pubescent and usually 3-fld.; calyx-lobes lanceolate or oblong-lanceolate; corolla about 1 in. long, the tube gradually dilated; sterile filament glabrous. Cent. Texas.—Under this name a coral-red pentstemon with fls. 1¼–1½ in. long is offered abroad, said to be Mexican.

12. *Hartwegii*, Benth. (*P. gentianoides*, Lindl.). Fig. 2860. Tall and erect (3–4 ft. high), somewhat branched, the sts. dark purple: lvs. lanceolate to lance-oblong-linear, or the upper ones broader, sessile, glabrous and entire: fl.-cluster somewhat pubescent, long and open, the pedicels 3–6-fld.; fls. drooping, dark rich scarlet-red, slightly curved, the limb somewhat 2-lipped and the lobes acute. Cool regions in Mex. B.M. 3661. B.R. 24:3. Gn. 37, p. 603; 49, p. 406. G. 2:391. J.F. 3:231. Gn.W. 23:679. G.L. 17:397. G.W. 2, p. 157 (as var. *hybridus grandiflorus*).—A fine garden plant, now much modified by domestication. *P. gentianoides*, Poir., and in F. S. 7:730, from S. Mex. and Guatemala, is kept distinct by Krautter, the infl. being a long leafy raceme rather than a loose naked panicle: fls. purplish.

13. *glaxinioides*, Hort. A race of garden hybrids, issuing largely from *P. Hartwegii*, the other most important parent being *P. Cobaea*. Probably other species have entered into the amalgamation. The group needs critical study from the growing plants. The fls. are large, with a broad nearly regular limb, and in many colors. The plants are strong and floriferous. Fls. sometimes measure 2 in. across. Some of the strains bloom freely from seed the first year. Not hardy in N. Y. unless very thoroughly protected; it is probably better to winter it in deep coldframe.

14. *centranthifolius*, Benth. (*Chelone centranthifolia*, Benth.). Plant strict and leafy, 1–3 ft. tall, very glaucous: lvs. thick and entire, from ovate-lanceolate

to linear, mostly sessile and clasping: infl. long and narrow, the peduncles 2-3-fld.; fls. about 1 in. long, scarlet, narrow-tubular, the lobes short and acute; sterile filament naked. Calif. to W. Ariz. B.M. 5142. B.R. 1737. F.S. 22:2309.

FF. Corolla (except in *P. rotundifolius*) with a prominently enlarging tube, which is often contracted near the base: thick-fld. species. Corolla nearly straight but short in *P. confertus*.

G. Lvs. entire (sometimes serrulate in *P. confertus*).

H. Infl. usually rather close and compact.

I. Some or all the lvs. lanceolate to broad-lanceolate.

15. *glaber*, Pursh (*P. Gordonii*, Hook. *P. speciosus*, Douglas). Erect herb (1-2 ft.), with simple sts. glabrous and somewhat glaucous: lvs. oblong-lanceolate to ovate-lanceolate: fl. 1 in. or more long, broad, and wide at the mouth, bright blue to purplish. Missouri River, west. B.M. 1672 (as *P. glabra*) and 4319. B.R. 1270. Gn. 27, p. 42. R.H. 1895, p. 383; 1896, p. 347. G.M. 44:563.—A very handsome plant, known by its large blue fls. Variable.

Var. cyananthus, Gray (*P. cyananthus*, Hook. *P. cyananthus*, Hort.). Tall and less glaucous, the lvs. broader (ovate or cordate-ovate to lance-ovate): fl.-cluster dense; fls. bright blue. Rocky Mts., Colo., Mont., Utah. B.M. 4464. F.S. 6:157. R.H. 1851: 453.—Preferable to the type.

By many considered to be specifically distinct.

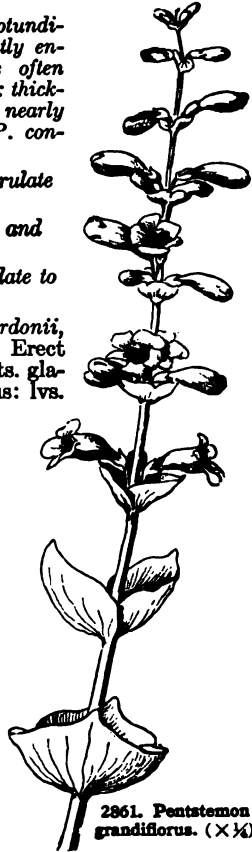
Var. alpinus, Gray (*P. alpinus*, Torr.). A foot or less high: st.-lvs. narrow- or broad-lanceolate: thyrses short and few-fld. High plains and mountains, Rocky Mts. Kept distinct from *P. glaber* by some authors.

II. Some or all the lvs. as broad as ovate, oval or obovate.

16. *arizonicus*, Heller. St. slender but erect, 6-8 in. high, usually with several leafy short prostrate branches at base: lvs. glabrous, dull green, coriaceous, oval and finely crenate or undulate on prostrate branches, oblanceolate to ovate-lanceolate on the erect sts. and crenate or entire: fls. in a lax more or less secund infl., purplish; calyx nearly $\frac{3}{4}$ in. long, pubescent and somewhat glandular, the lobes long-acuminate and ciliate; corolla about 1 in. long, minutely puberulent, abruptly dilated above calyx; sterile filament glabrous, not enlarged above. Mt. San Francisco, Ariz.

17. *puniceus*, Gray. Very glaucous, with short ovate sometimes connate lvs.: fl. about 1 in. long, more funnel-form (or widening upward) and with wide-spreading rounded lobes, scarlet; sterile filament bearded down one side. N. Mex. R.H. 1892, p. 448.

18. *Wrightii*, Hook. Rather stout, 2 ft. or less tall, more or less glaucous: lowest lvs. obovate, the upper ones oblong and clasping: infl. long and loosely fld., to peduncles about 2-fld.; fls. about $\frac{3}{4}$ in. long, bright red, the mouth broad and the rounded lobes spreading $\frac{1}{4}$ in.; sterile stamen bearded. W. Texas to Ariz. B.M. 4601. F.S. 7:685. J.F. 2:190.



19. *grandiflorus*, Nutt. Fig. 2861. Stout, very glaucous: lvs. thick, broad and obtuse, the floral ones with very broad bases: peduncles very short or almost none; fls. nearly or quite 2 in. long, lilac or blue, enlarging near the base, somewhat 2-lipped and the upper lip the smaller; sterile filament minutely pubescent at the tip: fr. large. Prairies, Ill. and Minn., westward. G. 29:82. —Handsome.

20. *Murrayanus*, Hook. Erect, 3 ft.: lvs. broad-ovate, clasping, and the upper pairs grown together into a cup-shaped body (connate): pedicels 2-3 in. long; fls. deep scarlet, with rather small lobes; sterile filament glabrous. Ark., Texas. B.M. 3472. Gn. 26, p. 229. R.H. 1896, p. 348.

21. *acuminatus*, Douglas. Glaucous, strict and usually stiffish, 2 ft. or less tall: lvs. thickish, the lowermost broadly ovate to obovate, the uppermost broad-lanceolate to broad-ovate and clasping and usually acuminate, the floral lvs. shorter than the fls.: infl. narrow, the peduncles 1-3 or more-fld.; fls. nearly 1 in. long, lilac to violet, wide at the throat, the obtuse lobes spreading; sterile filament bearded at the tip. Neb. and Minn., south and far westward. B.R. 1285. —Very satisfactory. There is confusion in the application of the name *P. acuminatus*. *P. nfidus*, Douglas (*P. Fendleri*, Gray), sometimes referred here, is considered to be a distinct species, with upper lvs. ovate or narrower. Sask. to Mex., and westward.

III. Some or all the lvs. lanceolate to linear.

22. *angustifolius*, Pursh (*P. caeruleus*, Nutt.). Fig. 2862. Mostly lower: lvs. linear to lanceolate, those at the base of the fl.-cluster usually exceeding the fls.: infl. usually close; fls. blue, varying to lilac or white. Dakota to Colo. and New Mex. G.M. 54:377.—Seems to run into *P. acuminatus*.

23. *secundiflorus*, Benth. About 2 ft. tall: lvs. narrow-lanceolate, somewhat glaucous, the radical ones spatulate: infl. long and strict, the peduncles 1-3-fld.; fls. lilac or purple, the basal tube about twice the length of the calyx, the throat broad and bell-shaped and about equaled by the spreading rounded lobes; sterile filament glabrous or bearded only at the top. Colo. and Wyo.—Handsome.

24. *confertus*, Douglas. One to 2 ft., pubescent in the infl.: lvs. oblong to lanceolate to linear, usually entire but sometimes minutely serrate: infl. a narrow interrupted spike, the peduncles sessile or the lower ones stalked; fls. $\frac{1}{2}$ in. or less long, cream-white to sulfur-yellow, narrow, 2-lipped, the lower lip bearded within. Rocky Mts. to Ore. and Calif. B.R. 1260. —Variable, and has received many names, but little known in cult.

Var. caeruleo-purpureus, Gray (*P. procerus*, Douglas). Fls. blue-purple to violet. Colo., west and north. B.M. 2954. L.B.C. 17:1616.—A common form in gardens, and a reliable and satisfactory plant, often kept as specifically distinct.



2862. *Pentstemon angustifolius*. A slender form. (x 1/2)

HH. Infl. very open and loose, due to the fact that the peduncles are 5-6 in. long and the pedicels 1 in. or more long and the fls. drooping.

25. *rotundifolius*, Gray. Fig. 2863. About 2 ft. tall, branching from the base, glaucous: lower lvs. thick and leathery, orbicular-ovate and obtuse, long-petioled, st.-lvs. sessile and cordate-orbicular: fls. 1-1½ in. long, narrow-tubular, yellow-red, the lobes short and acute; sterile filament glabrous. N. Mex. B.M. 7055. G.C. III. 4:265. G.F. 1:473 (reduced in Fig. 2863).

GG. Lvs. serrate or dentate.

H. Sterile filament bearded at the tip or along one side (Nos. 26-32).

I. Color of fls. purple, blue or rose, sometimes ranging to white.

26. *campanulatus*, Willd. Branching from the base, 2 ft. or less tall: lvs. lanceolate or the upper ones ovate-lanceolate, long-acuminate, broad at the base and sessile, strongly serrate: infl. long and narrow, the peduncles usually 2-fld.; fls. 1 in. long, rose-purple or violet (sometimes white in cult.), the corolla funnelform, the lobes rounded and spreading and the lower lip broader than the upper, the sterile filament hairy at the top. Mex. and Guatemala. B.M. 3884.—An old garden plant which is variable in color and which has received many names, as *P. angustifolius*, *P. atropurpureus*, *P. roseus*. See B.R. 1122. L.B.C. 15:1429, 1438. G.C. III. 50:93 (a white form). *P. pulchellus*, Lindl., by some referred here, is by others kept distinct, differing in corolla abruptly ventricose or swollen above, violet or lilac with white veins, the lips nearly equal, throat spotted and villous, sterile filament bearded at end. Mex. B.R. 1138.

27. *humilis*, Nutt. Low, usually not over 6 in. tall, pubescent in the infl.: lvs. oblong to lanceolate, somewhat glaucous, the upper ones small-toothed: infl. 3-4 in. long, with 2-5-fld. peduncles; fls. ½ in. long, rather narrow, deep blue or sometimes ranging to white, the lower lip bearded within. Rocky Mts., west. F. 1875:241.

28. *gracilis*, Nutt. Taller, sometimes minutely puberulent, slender: lvs. linear-lanceolate, sometimes nearly entire, the radical ones spatulate or oblong: infl. strict, the peduncles 2- or more-fld.; fls. nearly 1 in. long, mostly narrow-funnelform, lilac-purple ranging to white. Neb. to Colo. and northward, on moist prairies. B.M. 2945. L.B.C. 16:1541.—A pretty species.

II. Color of fls. nearly or quite white, but sometimes shaded with red or purple.

29. *tubiflorus*, Nutt. St. 2-3 ft., erect, not leafy above: lvs. oblong to ovate-lanceolate, barely serrulate, passing into small bracts above: infl.

of densely-fld., somewhat whorled clusters; fls. about ¾ in. long, scarcely 2-lipped, the spreading limb nearly as long as the tube, white or nearly so and sometimes tinged with purple. Mo., Kans., and Ark.

30. *laevigatus*, Soland. (*Chelone Pentstemon*, Linn.). Tall and slender, 2-4 ft., more or less glaucous: lvs. rather firm, purplish, somewhat glossy, ovate to ovate-oblong-lanceolate and clasping, the radical ones oblanceolate or broader, all small-toothed: infl. long and loose; fls. about 1 in. long, white and sometimes tinged with color, rather slender, narrow at the base, the short lobes not wide-spreading, the small lower lip bearded at the base. Pa., west and south. B.M. 1425.—A common plant, best known in the following form.

Var. *Digitalis*, Gray (*P. Digitalis*, Nutt. *Chelone Digitalis*, Sweet). Very tall, 4-5 ft., with larger white abruptly inflated fls. B.M. 2587.—Sometimes becomes a weed in old fields, from Maine south and west, but probably not indigenous in all this range. It is in cult., as a border plant. By some authors kept distinct as a species. *P. Smilii*, Heller, is a handsome allied species from N. C. and Tenn., with bright pink-purple gibbous corolla, pubescent or puberulent sts.: root-lvs. oval or ovate; st.-lvs. lanceolate or ovate-lanceolate, smooth both sides, serrate.

31. *Palmeri*, Gray. Plant 2-3 ft. tall, the foliage glaucous: lvs. thick, ovate to oblong-lanceolate, the lower petioled and the upper connate, very sharp-dentate or sometimes almost entire: infl. long, mostly glandular; fls. cream-white tinted with pink, the narrow part of the tube about as long as the calyx, the upper part very wide and open, the mouth ¾ in. across and 2-lipped; sterile filament yellow-bearded. Utah, south and west. B.M. 6064. F.S. 20:2094. F. 1874:37.

III. Color of fls. red.

32. *Clavelandii*, Gray. Two ft. or above, more or less glaucous, becoming woody at the base: lvs. rigid, oblong or ovate, sharp-toothed, the upper ones usually connate by their bases: infl. long and narrow; fls. ¾ in. long, crimson, with narrow throat; sterile filament bearded at top. S. Calif. and Low. Calif. G.M. 36: 626. F. 1878, p. 149.

HH. Sterile filament glabrous.

33. *deustus*, Douglas. Sts. 1 ft. or less tall, from a woody base, glabrous throughout: lvs. thickish, varying from nearly linear to lanceolate to ovate, some or all of them serrate, the uppermost sessile: infl. many-fld., loose and open; fls. not over ½ in. long, dull white or yellowish white and sometimes tinged with purple, wide-mouthed, the lobes wide-spreading. Mont. and Wyo. to Calif. B.R. 1318.

34. *spectabilis*, Thurb. Two to 4 ft., erect, somewhat glaucous: lvs. ovate to ovate-lanceolate or sometimes oblong, acute, the upper ones acuminate and connate by their bases, very sharp serrate-dentate: infl. long and many-fld.; fl. 1 in. or more long, rose-purple or lilac, the narrow part of the tube about twice the length of the calyx, the upper part broad and full, the lobes rounded. New Mex. to S. Calif. B.M. 5260.—A beautiful species.

EE. St. and lvs. more or less pubescent or hirsute.

F. Corolla 2 in. long.

35. *Cobaea*, Nutt. Fig. 2864. Straight and erect, stout, about 2 ft., minutely pubescent: lvs. thick, ovate-oblong to oblong to broad-lanceolate, the upper ones clasping: infl. mostly simple and open; fls. very large, reddish purple to white, the base very narrow but the upper part of the fl. broad and open, the limb only obscurely 2-lipped; sterile filament bearded. Prairies, Mo. and Neb., south. B.M. 3465. Gn. 49:406. G. 29:83. F.S.R.2, p. 271. Mn. 4:113.—Very showy, and probably one of the parents of the garden race of hybrid pentstemons (see No. 13).



2863. *Pentstemon rotundifolius*. (× ¼)

FF. Corolla 1 in. or less long.

36. *erianthera*, Pursh (*P. cristatus*, Nutt.). Only a few inches high, pubescent, usually viscid above: lvs. linear-lanceolate to narrow-oblong: infl. erect, leafy below; fls. about 1 in. long, purplish, rather abruptly dilated above, the lower lip bearded; sterile filament strongly yellow-bearded. Dakota to Colo., north and west.—Good.

37. *ovatus*, Douglas. St. slender but erect, 2–4 ft., more or less pubescent: lvs. ovate, rather thin, bright green, serrate, the upper ones clasping: infl. erect but lax, the peduncles 2- to several-fld.; fls. about $\frac{3}{4}$ in. long, blue changing to purple, 2-lipped and the lower lip bearded. Idaho, west and north. B.M. 2903.—Good.

38. *hirsutus*, Willd. (*P. pubescens*, Soland. *Chelone hirsuta*, Linn.). Loose-growing, the slender often decumbent sts. reaching 2 ft., usually viscid-pubescent: lvs. oblong to narrow-lanceolate, small-toothed, the radical ones ovate to spatulate: infl. loose and open, the peduncles 2–3 in. long and the pedicels often 1 in. long; fls. about 1 in. long, drooping, dull purple or violet or varying to flesh-color, rather narrow, with 2 short lobes densely bearded on the palate; sterile filament densely bearded. Dry fields and banks from Maine and Ont. to Fla. and Texas. B.M. 1424. G.M. 56:493.—The common pentstemon of the E., and useful in cult. *P. Mackayanus*, Knowles & Westc., is perhaps distinct: corolla often shorter, sparingly bearded in throat, purple: upper st.-lvs. with dilated or rounded bases rather than narrow-lanceolate. Ala. to Ark.

AA. Cells of anthers not dehiscing or opening to the base, the basal part remaining saccate

B. Lvs. dentate or serrate.

c. Plant viscid and soft-pubescent.

39. *glandulosus*, Douglas (*P. staticifolius*, Lindl.). Rather stout, 2–3 ft. tall: lvs. rather thin, ovate-lanceolate, acuminate, the upper ones clasping, the radical ovate or oblong, all toothed or serrate: infl. narrow, leafy below, the peduncles few- to several-fld.; fls. large, somewhat over 1 in. long, lilac, with inflated throat, the lips short and broad; sterile filament glabrous. Idaho to Wash. and Ore. B.M. 3688. B.R. 1262; 1770.—Showy.

cc. Plant not viscid, either glabrous or puberulent.

40. *venustus*, Douglas. St. erect, nearly simple, leafy, 2 ft. or less tall, glabrous: lvs. thickish, oblong-lanceolate to ovate-lanceolate, very sharply serrate: infl. narrow, not leafy, the peduncles 1–3-fld.; fls. usually more than 1 in. long, somewhat 2-lipped, light purple, somewhat hairy within; sterile filament hairy above. Idaho, Ore., and Wash. B.R. 1309.

41. *diffusus*, Douglas (*P. argutus*, Paxt.). Sts. about 2 ft. tall, diffuse: lvs. ovate to oblong-lanceolate to cordate-ovate, unevenly and deeply serrate: infl. leafy, the pedicels very short; fls. $\frac{3}{4}$ in. long, light purple, 2-lipped; sterile filament hairy above. Ore., north. B.M. 3645. B.R. 1132. R.H. 1872:410.

BB. Lvs. deep-cut.

42. *Richardsonii*, Douglas. Rather loosely branching: lvs. ovate-lanceolate to narrow-lanceolate, deeply cut or pinnatifid, the upper ones not opposite: infl. loose; fls. $\frac{3}{4}$ in. long, light purple; sterile filament somewhat hairy at top. Ore. and Wash. B.M. 3391. B.R. 1121. L.B.C. 17:1641.

BBB. Lvs. entire.

c. Sterile filament somewhat bearded.

43. *gracilentus*, Gray. A foot or more tall from a woody base, naked above: lvs. lanceolate to linear or oblong, glabrous: infl. loose, the viscid peduncles 2–5-fld.; fls. $\frac{1}{2}$ in. long, violet-blue, the lobes very short. N. Calif., Nev., and Ore.

cc. Sterile filament glabrous.

44. *latus*, Gray. About 1 ft. tall, from a woody base, closely pubescent: lvs. lanceolate to linear-lanceolate, the radical ones spatulate: fls. 1 in. long, blue. Calif. and Nev.

45. *Roßzii*, Regel. Smaller than the last, 1 ft. or less, glabrous or minutely puberulent below: lvs. lanceolate, linear, or oblanceolate: fls. pale blue or violet, on divergent branches, the corolla $\frac{1}{2}$ – $\frac{3}{4}$ in. long. Nev., Calif., Ore.—The plant cult. under this name may be, in some cases, *P. azureus* var. *Jaffrayanus*.

46. *azureus*, Benth. Erect or ascending, 3 ft. or less, glaucous, sometimes minutely pubescent: lvs. narrow-ovate to narrow-lanceolate: infl. loose and open; fls. $1\frac{1}{2}$ in. or less long, blue to violet, sometimes reddish at the base, the limb about 1 in. across. Calif. B.M. 7504. J.F. 2:211.

Var. *Jaffrayanus*, Gray (*P. Jaffrayanus*, Hook.). Lower (about 1 ft. tall), young sts. tinged with red: lvs. oblong to oval or the upper ones ovate-lanceolate, glaucous: fls. large and showy, rich blue and reddish at base and in the throat. Calif. B.M. 5045. R.H. 1874:430. H. F.II. 1:5. G.C. III. 58:67.—By some kept specifically distinct.

47. *heterophyllus*, Lindl. Sts. reaching 3–5 ft., from a woody base, the plant mostly green: lvs. varying from oblong-lanceolate above to lanceolate and linear below: infl. loose and open, the peduncles usually 1- or 2-fld.; fls. about 1 in. long, pink or rose-purple, very slender at the base but full or inflated above, the lips well marked. Calif. B.R. 1899. B.M. 3853. R.H. 1875:110; 1896, p. 348; 1901:164.

48. *Bridgesii*, Gray. Sts. 1–2 ft., from a somewhat woody base, glabrous or perhaps puberulent up to the thyrse: lvs. lanceolate to linear: peduncles 1–5-fld., short, glandular; corolla about 1 in. long, bright scarlet, narrow, the lips one-third length of tube; anthers sagittate. S. W. Colo. and N. Ariz. to Calif. Gn. 66, p. 348.

As the pentstemons are mostly attractive plants, any number of them may appear in the lists of distributors of native plants. *P. baccharifolius*, Hook. Glabrous or only obscurely puberulent, leafy at base, 2 ft.: lvs. oblong, sharp-toothed, sessile: fls. deep carmine-red, on 1–3-fld. peduncles; corolla 1 in. long, broadly tubular, with short 2-lipped limb; sterile filament naked. Texas. J.F. 3:227.—*P. pygmaeus* is a name listed abroad: "very compact-growing; pale purple and white fls."—*P. virgatus*, Gray. Glabrous or slightly glandular, the st. strict and long: lvs. linear-lanceolate: fls. lilac with purple veins, in a virgate thyrse; corolla $\frac{1}{4}$ in. long, with a wide throat and distinctly 2-lipped. New Mex., Ariz.

L. H. B.

PEONY: *Paeonia*.

PEPEROMIA (Greek, *pepper-like*). *Piperaceae*. An enormous genus of tropical and subtropical herbs, including a few small but choice foliage plants for warmhouse, conservatory, or house decoration.

Annual, or perennial by a creeping caudex or by



2864. *Pentstemon Cobaea*. (× $\frac{1}{4}$)

tubers formed at the base: sts. prostrate, creeping and thread-like, or erect and slender, or short thick, and succulent: lvs. alternate, opposite, or in whorls of 3-4 (rarely 5-6), entire, fleshy or membranous, often with pellucid dots, sometimes attractively veined or colored: fls. minute, usually disposed in a dense spike; stamens 2; anther-cells confluent; stigma sessile, undivided, often tufted: fr. a small or minute berry, 1-seeded, with thin pericarp.



2865. *Peperomia Sandersii*, usually known as *P. arifolia* var. *argyreia*.

—Species perhaps 500 or more, widely dispersed, but mostly in Amer., from Fla. to Chile and Argentina. Very few are cult. The names of peperomias are much confused, partly owing to the vast size of the genus, which always increases the difficulties of discrimination, and partly to the minuteness of the fls. Moreover, the duration

of many kinds is uncertain, while great numbers are monocarpic, that is, they flower and fruit once and then die. In the following account, the names are those that mostly appear in the trade and in horticultural literature; how far these names may be properly determined botanically is a subject for investigation.

Peperomias are very attractive and beautiful small-stature glasshouse plants, having particularly a very decorative appearance among other foliage plants. For their general culture they need a warm house. By the end of January they will become active both in root and foliage. From February on they will stand an increase in temperature to about 62° at night; this may be increased until they are having 65° to 70° with an increase of 10° to 15° on bright days. As the sun gets powerful in the spring, they will need shade, or as soon as the foliage shows signs of losing color. In the summer they need a good supply of water, but in autumn and winter they require very careful watering. In spring and summer they profit by frequent light spraying. Keep the atmosphere of the house in a moist state, but avoid a stuffy or stagnant condition. In the slow time of winter, they will stand the temperature to be lowered to about 60° with 10° to 15° increase with sun. Give less spraying and be very careful in giving water during the dark and dull time, otherwise the roots will rot. They can be propagated readily from pieces of the stems or leaves placed in pans of silver sand and plunged where they will have bottom heat of 75° to 80°. Do not cover with glass as it tends to make them rot. Keep shaded and be very careful about watering, and they will soon root. When they make sufficient roots, they may be potted up into small pots, using loam four parts, fibrous peat two parts, and enough sand to keep it open. For larger shifts, use a more lumpy mixture of fibrous loam, fibrous peat, and well-decayed cow-manure. By July or August they should get their last shift, until the coming of spring. They will stand full sun by the end of September and through the winter, and this greatly aids in keeping them in good condition at that season. (J. J. M. Farrell.)

A. Plants for pots or pans, erect-habited.

B. Lvs. alternate.

C. Sts. short or wanting.

Sandersii, A. DC. (*P. arifolia*, Hort., not Miq.). Fig. 2865. Stemless: lvs. alternate, peltate, 5 x 3½ in.,

rounded at base; petioles dark red, 4-8 in. long. Cult. only in the form var. *argyreia*, Hook. f., which differs from the type in having broad, parallel longitudinal bands of white between the nerves. Brazil. B.M. 5634. F.S. 23:2438. G. 25:197. A.G. 19:17. F.R. 1:637.—This plant seems to be the commonest in cult. here, under the name of *P. arifolia* var. *argyreia*. However, Casimir DeCandolle thought that this plant is not the true *P. arifolia*, and he renamed it *P. Sandersii* (after Wilson Sanders), but the name is often spelled *Saundersii* in trade catalogues. The distinctions which DeCandolle makes are technical. The evident ones are that *P. arifolia* has a short st. and catkins much longer than the lvs., while *P. Sandersii* has no st. and the catkins are about as long as the lvs.

Verschaffeltii, Lem. Distinguished from *P. marmorata*, which it much resembles, by the lvs. being alternate, by the basal lobes, which do not overlap but are separated by a notch as in a typical cordate lf. A smaller and more delicate but more branched plant: st. short: st., branches, petioles, and peduncles much longer, translucent, and pale rose (not green): lvs. heart-shaped at base. Upper Amazon, Brazil. I.H. 16:598.

tithymaloides, A. Dietr. (*P. magnoliaefolia*, A. Dietr.). Lvs. alternate, subovate, acutish, narrowed at base, 2-3 in. long, base acute, more than 9-nerved; nerves subopposite; petiole 1 in. long, keeled beneath: st. rooting below. Santo Domingo.—Monocarpic (annual or biennial.)

maculosa, A. Dietr. Lvs. alternate(?), ovate-lanceolate, bright shining green, very fleshy; petioles beautifully spotted with purple. Santo Domingo.—A good subject for a pan. Perennial.

CC. Sts. numerous, long, slender.

metallica, Lind. & Rod., is distinct from all others here described by its numerous slender unbranched sts. 12-16 in. high, and lanceolate lvs. It probably belongs in some other genus or family. It was intro. in 1892 before the fls. were known and its exact botanical position determined. Lvs. blackish green, painted white down the middle, red-veined below; petioles short, reddish brown. Peru. I.H. 39:157. G.W. 3, p. 160.

BB. Lvs. opposite or in whorls.

marmorata, Hook. St. short, much-branched, nearly ½ in. thick: lvs. opposite, ovate-cordate, deeply 2-lobed at the base, the lobes rounded and overlapping. The lvs. are 3-5 x 1½-2¼ in., not so broad as *P. Sandersii*, and less concave. Not advertised, but has been unnecessarily confused with *P. Sandersii*.

latifolia, Miq. St. 10 in. high, decumbent: lvs. obovate or obtusely ovate, 5-7-nerved, opposite or in whorls of 3, base acute, glabrous above, pubescent beneath; petiole 7-8 lines long. Hawaii.—Monocarpic (annual or biennial).

AA. Plants for hanging-baskets, drooping.

nummularifolia, HBK. Delicate creeper, with long, thread-like, rooting sts. and small orbicular lvs., puberulous or glabrate: lvs. alternate, ciliate, obscurely palmately 3-nerved, 3-4 lines diam. Trop. Amer.—The above description is from Grisebach. Five other species in the W. Indies have the same habit. *P. prostrata*, Hort., is probably a synonym. It is a stove basket-plant figured in G.C. II. 11:717 and F. 1881, p. 103, with a good-sized petiole. The lvs. are very small for the genus, and are said not to exceed ¾ in. Lvs. bordered and nerved with greenish white. Annual. Nicholson refers *P. prostrata* to *P. brevipes*, and keeps *P. nummularifolia* separate. *P. brevipes*, C. DC., has lvs. alternate, orbiculate, younger ones hirsute, older ones glabrate, ciliate, 1-nerved: style none: berry with a very short stipe. Trop. Amer.

In some collections is a plant known as *P. crassifolia* (which is probably not *P. crassifolia*, Baker, of Trop. Afr.). It is a very distinct species with dark green, ovate, fleshy lvs. 3×5 in., becoming very hard when old: sts. branched and upright in habit, a foot in height: fls. in insignificant catkins. It is a very good plant and deserves to be more generally known.—*P. pubifolia*, Veitch. Perennial creeper of unknown habitat, suitable for hanging-baskets. Lvs. small, ovate, marked with a central gray bar.—*P. reesei*, André, intro. in 1865, was "found in all stoves" 2 years later and said to be "a plant for the million." It differs from all the above in being a flowering plant rather than a foliage plant, for the lvs. are merely bordered lighter green and the fls. are about as showy as those of a mignonette, each one 3-4 lines long, and 100 or so in a raceme. St. $1-1\frac{1}{2}$ ft. high, red, forked: lvs. broadly ovate, cordate. Colombia. B.M. 6619.

WILHELM MILLER.

L. H. B.†

PEPÓNIA (Greek, *melon, gourd*). *Cucurbitaceæ*. Climbing or sprawling plants, little known in horticulture.

Perennial herbs, prostrate or scandent, often villous, with fibrous roots: lvs. lobed or rarely entire, dentate: fls. large, yellow or whitish, monœcious, the males solitary or racemose; corolla-lobes 5, obovate; stamens 3; female fls. solitary: fr. large or medium, fleshy, oblong or cylindrical; seeds many, black, flattened.—Species about a dozen in Trop. and S. Afr. Because of an earlier genus of the same name, Engler has proposed the name *Peponium* for this group.

Mackénii, Naudin. Lvs. broadly ovate-cordate, 5-lobed to the middle: male fls. solitary; calyx-tube subglabrous, narrowed from apex to base. It is hardly scandent, densely villous and the st. grows $\frac{1}{2}$ -6 ft. long: lvs. 4 in. long: petals over 1 in. long: fr. oblong-ovoid, about the size of a hen's egg, green at first, then marbled with white, finally all red; pulp orange-colored, insipid. Natal.—Once intro. in S. Calif., but now apparently lost; probably not of much value as an ornamental.

L. H. B.

PEPPER. With American horticulturists "pepper" usually means the red pepper (*Capsicum*, which see) of which the green pepper is merely the unripe stage. The black and white pepper of commerce are treated under *Piper*.

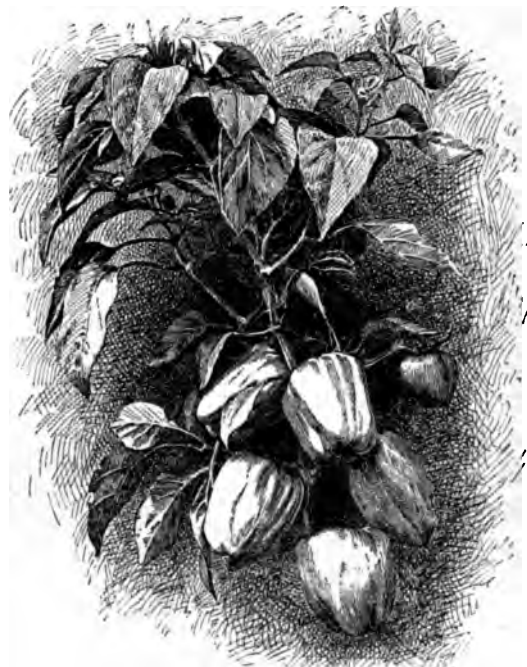
The red pepper (*Capsicum*) is doubtless native of the New World, as there is no record of its having been known prior to the discovery of America. According to Irving's "Life of Columbus," this plant was first mentioned by Martyr in 1493, who says Columbus brought home "pepper more pungent than that from Caucasus," evidently comparing it with the black pepper of commerce from the oriental countries. It was cultivated by the natives in tropical and southern America before this time, and about a century later Gerarde speaks of its being brought into European gardens from Africa and southern Asia. The ease with which the plant spreads in warm latitudes, together with the increased commercial trade immediately following the discovery of America, doubtless caused a rapid dissemination through tropical Asia and Africa, where it was supposed by many to be indigenous and from there introduced into European gardens.

The first record of the use of pepper is apparently by Chauca, physician to the fleet of Columbus, who in 1494 alludes to it as a condiment. Writers about a century later considered it valuable as an aid to digestion and also mentioned its use in dressing meats, dyeing, and other purposes. Medicinally it was much used for various ailments, such as dropsy, colic, ague, and toothache, and when mixed with honey and applied externally was used as a remedy for quinsy. At a later date preparations were given for black vomit and various tropical fevers, and for a tonic, also for gout, paralysis and other diseases. Its modern use is largely as a condiment, forming a seasoning in almost every dish eaten by the inhabitants of warm countries. The smaller varieties are mostly used for this purpose. The cayenne pepper of commerce consists of the small pungent fruits reduced to a powder. The unground

fruit is also made into pepper sauce of various brands by preserving in brine or strong vinegar. The Tabasco variety furnishes the well-known Tabasco pepper sauce and Tabasco catsup. "Chilli con carne," consists of the small pungent varieties finely ground and mixed with meat. These hot varieties are often eaten raw by native Mexicans, as are radishes, and also form an important ingredient of tamales so common in that country and fairly well known in the southern United States. The large thick-fleshed sweet varieties are desired more by persons farther north, who use them in various ways, served like tomatoes in either ripe or green state, with vinegar and salt, or made into mangoes by cutting one side, removing seeds and filling with chow-chow pickles. The parts are then tied together, placed in jars with vinegar and kept until wanted. The fruit is often used in stuffing pitted olives after being cooked in olive oil. In Spain some are canned after being thus cooked and eaten with French salad dressing.

Paprika is a well-known Hungarian and Spanish condiment made from the long, and more or less pointed type of peppers. The Spanish paprika is much milder in flavor than the Hungarian, it being made from a less pungent pepper and doubtless in its preparation more of the seeds and placentæ are removed, which process makes a milder condiment. The seed of peppers is more or less used as a bird food; and the plants of some varieties, like Little Gem and Celestial, are grown more especially for ornamental purposes.

Some thirty varieties are recorded by American seedsmen. They differ from one another mainly in the form and pungency of fruit and habit of growth. There are endless forms among peppers, but certain types are



2866. Pepper.—The Ruby King variety.

well fixed, as indicated by the botanical varieties under *Capsicum*. Pungency is to be found in all peppers and while located in the placentæ, other parts may acquire it by contact. Most of the smaller sorts, like Coral Gem, Tabasco, Chilli, Cayenne, and Cherry contain more of the pungent properties than the large kinds, like Ruby King (Fig. 2866), Squash, Bell, Sweet Mountain, and Golden Queen. Some medium-sized varieties,

like Long Red, Celestial, and Oxheart, are hot; others, like County Fair and Kaleidoscope, are mild.

Peppers are classed as one of the minor vegetables in that they have not been grown in large quantities in any one locality and the aggregate production is smaller than the so-called truck crops, such as tomatoes, cucumbers, and the like. Most gardens near large cities in the central and southern states have been growing a few to supply the local markets. During the last decade there has been a decided increase in acreage. The census report for 1900 gives no report of production of peppers, but for 1910 there were recorded for the United States, 1,641 farms containing 3,483 acres, valued at \$408,741, an average of \$117.47 an acre. Four states with the largest acreage are:

	No. of farms	Acres a farm	Aver. area	Value	Aver. value an acre
New Jersey.....	822	1,882	2.29	\$149,432	\$79 40
California.....	55	417	7.56	52,294	124 92
Florida.....	143	296	2.07	94,246	318 40
New Mexico.....	266	280	0.97	17,228	66 26

This record ignores quantities of less than an acre with the evident exception of New Mexico, which averages .03 less than 1 acre to a farm.

It is estimated that approximately 4,000,000 pounds of paprika were imported each year during the last three or four years. The United States Department of Agriculture has demonstrated that this product can be profitably produced in the South, but if the consumption is limited to the above figure the acreage must continue to be very limited.

In growing peppers, the seed is usually planted under glass in February or March, and the young plants transplanted to pots or boxes when of sufficient size to handle. From twelve to twenty days are required for the seed to germinate, the time varying according to the age of the seed and the manner in which it has been kept. Its germinating power is said to last four years, and if kept in pods until sown will grow when six or seven years old. A light warm soil, heavily charged with humus and one that will not quickly dry out, appears to be the best. In May or June, or after all danger of frost is past, the plants (Fig. 2867) are set in the field in rows about 2½ feet apart and 18 inches apart in the rows.

The ground is kept thoroughly cultivated, not only to keep down weeds but to maintain an even but not excessive moisture at all times, which is very essential for best results in growing this plant. By keeping the soil well worked up around the plants, they stand up much better against the winds and weight of their own fruit. Pruning or pinching the tip ends after the fruit begins to mature is occasionally recommended, but is rarely practised except when specimens of especially fine fruit are desired, in which case the fruit is thinned, leaving only a few on each plant of the larger sorts. In gathering, the fruit should not be torn off but cut with a knife or scissors, leaving at least 1 inch of stem. The usual vegetable crate is used for packing and marketing the crop.

Insects rarely injure peppers growing in the field. The pepper weevil (*Anthonomus eugenii*) has done some damage to crops in the South. It is said to be easily



2867. Pepper plant ready to transplant to the field.

kept in control by gathering and destroying infested pods. Tomato-worm, bollworm, white-fly and Colorado potato-beetle sometimes attack the plant, but seldom do noticeable injury. Red-spider and green-fly (aphis) frequently attack plants growing under glass. The red-spider may be kept in check by repeatedly syringing with water, and the green-fly may be killed by fumigating with tobacco dust. Two fungous diseases frequently occur on the large varieties growing outdoors. One is a pink anthracnose (*Glaesporium piperatum*), which causes the fruit to rot about the time it begins to ripen; the other is a dark anthracnose (*Colletotrichum nigrum*).

In preparing peppers for table use, handle them with gloves to prevent burning the fingers. Neither soap nor water will soothe hands burned by peppers, but milk will.

H. C. IRISH.

PEPPER-GRASS: *Lepidium*.

PEPPERMINT: *Mentha*. P. Stringy-bark: *Eucalyptus piperita*.

PEPPER-ROOT: *Dentaria diphylla*.

PERAPHYLLUM (from Greek, *pera*, excessively, and *phyllon*; alluding to the crowded lvs.). *Rosaceæ*, subfam. *Pomeæ*. A much-branched rigid shrub, with deciduous alternate rather small and narrow partly fasciated lvs., white fls. similar to apple-blossoms in few-fld. upright umbels appearing with the lvs., and berry-like edible fr. Hardy as far north as Mass., but seems to possess only little ornamental value. It is of very slow growth and blooms only when rather old. It grows in well-drained soil and in sunny position, and is best suited to be planted on rocky slopes of southern aspect. Prop. by seeds and layers and by grafting on amelanchier or crataegus. It is closely allied to *Amelanchier*, but distinguished by its nearly umbellate fls., cylindric calyx-tube, the perfectly inferior ovary, and also by its narrow lvs. The only species is *P. ramosissimum*, Nutt., a rigid shrub, 2-6 ft. high: lvs. oblong to oblanceolate, almost sessile, entire or sparingly serrulate, silky pubescent when young, ¾-2 in. long; fls. in few-fld. erect umbel-like racemes, white or slightly tinged pink, with rose-colored disk, ¼ in. across; petals obovate, spreading; styles 2-3, free; ovary 2- or incompletely 4-celled; fr. pendulous, globose, yellow with brownish cheek, about ½ in. across. May. Ore. to Calif. and Colo. B.M. 7420.

ALFRED REHDER.

PERENNIALS tend to live from year to year, as opposed to annuals and biennials, which die root and branch after flowering and fruiting. Annuals live only one year, biennials two years. Perennials include trees, shrubs and herbs, the two former being woody, the latter not. "Perennials," as commonly used by gardeners, is a convenient shortening of the phrase "hardy herbaceous perennials," which includes peony, phlox and other non-woody plants whose roots live over the winter while their tops may die to the ground. The phrase "hardy herbaceous perennials" is also shortened in common speech to "herbaceous plants;" or one speaks of the "hardy border." See *Herbs and Border*; also *Annuals and Biennials*.

A popular fallacy about perennials lies in the common statement that "they die down every year and come up again in the spring." Many of them never come up after two or three years of flowering; that is, perennials are not necessarily perpetual. Peonies may be as long-lived as shrubbery, and a clump of fraxinella has been known to outlive father, son, and grandson in the same spot. But these are exceptions. The general practice with perennials is to divide them every second or third year. Nearly all hardy herbaceous plants should be lifted now and then, because the crowns that give the flowers in most desirable kinds flower only two or three seasons and then die; but the plant may be continually spreading and making new growths, which



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LXXXVII. A branch of *Pereskia aculeata*, one of the leaf-bearing cacti.

furnish the flowers, and, unless lifted and divided, the stocks become scattering and unattractive. Another very good reason for lifting and dividing the perennials is that, being mostly strong-rooted plants, they deplete the soil; when shifted, they are likely to be set in a new place.

PERÉSKIA (named for Nicolas Claude Fabry de Peiresc). Also written *Peirescia*, *Peireskia*, and *Perescia*. *Cactaceæ*. Shrubs or clambering vines, grown for ornament and also for the edible fruit.

Spines in the axils in the lvs.: lvs. alternate, broad and flat, resembling those of ordinary flowering plants: fls. wheel-shaped, more or less clustered; ovary naked or leafy: fr. juicy, sometimes edible; seeds black, thin-shelled.—Some 40 names have been given in *Pereskia* for species in this and related genera, but only 13 are now recognized. Only two species are very common in collections, although *P. cubensis*, *P. amapola*, and the true *P. Bleo* have recently been intro.

aculeata, Mill. (*Cactus Pereskia*, Linn. *Pereskia fetans*, Speg.). **LEMON VINE. BLADE APPLE. BARBADOS GOOSEBERRY.** Branches woody, clambering, 10-20 ft. long: lvs. flat, lanceolate, 2-3 in. long, 1-2 in. broad: spines on old wood in clusters and straight, 1-2 in. long, on young branches 2, short and curved: fls. pale yellow with pink varieties, 1-1½ in. broad: fr. lemon-colored, the size of an olive, in age smooth. Widely spread in Trop. Amer. B.M. 7147. B.R. 1928. G.C. III. 20:625.—This species is much used as stock on which to graft other species of cacti. Var. *Godseffiana*, Hort. Lvs. richly colored, when young crimson, yellow and green above. G.C. III. 43:257 (note).

grandifolia, Haw. (*P. Bleo* of authors, not *Cactus Bleo*, HBK.). Usually tall shrubs, but sometimes growing as half clambering: lvs. often large, some 5 in. long: spines form large clusters on the old wood, usually solitary on young branches, straight: fls. in small clusters, purple, 1½-2 in. broad: fr. 2 in. long, pear-shaped. Brazil, and now grown in many warm countries. B.M. 3478. G.C. III. 20:427.

P. subulata, and *P. spathulata* are to be excluded from *Pereskia*. Schumann in his Monograph of the *Cactaceæ* referred them to the genus *Opuntia*, but they more properly belong to the genus *Pereskiopeis*, Brit. & Rose, which see.

J. N. ROSE.

PERESKIOPSIS (like *Pereskia*). *Cactaceæ*. *Opuntia*-like plants grown for ornament and curiosity.

Trees and shrubs: sts. and branches cylindrical: lvs. large, flat, and persistent: areoles bearing spines and glochids: fr. usually red; seeds covered with matted hairs. This genus, lately segregated from *Opuntia*, where recent writers have placed it, is very different from *Opuntia* in many ways, and resembles more closely in habit and foliage the genus *Pereskia*, although it is very different in fr. and seeds from that genus.—Eleven species have been recognized, of which 9 are now grown in Washington and in the New York Botanical Garden, although none is known in the trade.

velutina, Rose. Sts. weak, forming compact bushes: branches soft, velvety: lvs. broadly ovate: fls. yellow. Mex.

subulata, Brit. & Rose (*Pereskia subulata*, Muehl.). St. 2 ft. or less high, below half wood, above fleshy and branching: lvs. persisting a few years, dark green, shiny, as thick as a pencil, about 3 in. long, half-cylindrical and ending in a spine: areoles felted, in the young plant with a few hair-bristles, later with 2-4 straight, pale yellow spines 3-4 in. long. Mex.—Can be used as stock for epiphyllum.

spathulata, Brit. & Rose (*Pereskia spathulata*, Otto). St. upright, with few horizontal, spatulate, shiny green lvs.: the diffuse areoles at first somewhat woolly, later felted, above with a bunch of short bristles, below with 1-2 yellowish white, straight spines. Mex.

J. N. ROSE.

PERFUMERY-GARDENING. The growing of plants commercially as a source for perfume-making.

The perfumes of the market are derived in part from animal secretions (musk, civet), in part from artificial chemical compounds, and in part, and chiefly, from the class of vegetable products loosely called essential oils. "Synthetic" or chemical perfumery materials are the more or less perfect artificial reproductions of organic compounds used in perfumery. If it were possible in all cases and with perfect success to compound these substances, the production of floral perfumes would soon be at an end, as the chemical process would be sure to be cheaper than the horticultural. But nature knows how to add some touches which the chemist's art cannot imitate, and even when synthetic manufacture is possible, the result is in general regarded as a cheaper substitute. At the same time, sentimental reasons count considerably in favor of the natural perfume, and considering, further, that some perfumes cannot well be imitated chemically, there is no present cause to apprehend the extinction, or, in view of increasing demand, even the decline, of the industry of producing natural perfumery oils.

The essential oils used in perfumery are secreted in different parts of the plant. The flowers are naturally thought of first, being the seat of the fragrance of the rose, violet, cassie, jasmine, tuberose, the orange in part, and numberless other plants whose perfume is extracted or only enjoyed as naturally exhaled. The oil of lavender is yielded more by the green parts of the flower-head than by the corollas. In rose geranium, thyme, wintergreen, and patchouli the foliage is the fragrant part. A number of essences are derived from woods, as those of sandalwood, red cedar, and rhodium. The oil of sweet birch comes partly from the wood, but mainly from the inner bark, and the same is true of sassafras. In the case of the latter, however, the roots only are used; in the case of the former, the young tops. Several herbaceous roots also furnish oils, as orris-root, Canada snakeroot, and sweet flag. The rinds of the orange and other citrous fruits contain important perfumery oils, and the oil of bitter almonds comes from the fermented kernel of the nut.

The standard methods of extracting essential oils are four, namely, the use of mechanical means (chiefly expression), distillation, *enfleurage* or inflowering, and maceration. Expression appears to be applied only to the rinds of the citrous fruits. These are placed under pressure in a screw press, or sections turned wrong side out are squeezed in the fingers, the oil being taken up with a sponge, or the fruit is rubbed in a cup lined with spikes (*écuelle à piquer*), the oil collecting in a hollow handle. An *écuelle* on a larger scale in the shape of a hollow drum has also been used.

In distillation, the oil-bearing material is heated with water or subjected to hot steam, and the oil, being volatile, passes off with the steam. The oil would be lost if the vapor were not condensed, and this is accomplished by passing it through a coil or equivalent arrangement of pipe kept cool by a flow of water. The condensed steam and oil fall into a "Florentine recipient," a vessel with a spout coming out at the base but rising to the level of the top, so that the heavier liquid, sometimes oil, sometimes water, alone will enter it and can be poured off separately. After the water and oil have mainly separated, the water will still contain enough oil to make it highly fragrant, and in this state it goes to market as rose-water, orange-flower water, and the like, or is returned to the still to be redistilled with the next charge.

The remaining two methods depend on the fact that grease has the power of absorbing essential oils. In *enfleurage* the grease, without heating, is spread over both surfaces of panes of glass which are set in frames (*châssis*), so that they can be piled one over another with spaces between. In these spaces are placed the

flowers, the charge being renewed daily until the grease is sufficiently impregnated, when it constitutes a "pomade." "Extracts" are made by digesting the pomade in alcohol, which has a still stronger attraction for the perfume than has the grease. The alcohol must first be deodorized, to save perverting the floral perfume, and is then known as "Cologne spirit." The grease used in this and the next process, moreover, must be freed from all corruptible matter by a special process. Tallow and lard, commonly mixed, and sometimes the fat of the deer and other animals, are employed.

In maceration, the pomade is produced by immersing repeated charges of the flowers in melted grease or fine olive oil.

In recent times, various chemical processes for extracting perfumery have been tried, apparently with some practical success; but they have not yet supplanted the old methods. Carbon bisulfid and petroleum ether are among the solvents employed. These methods would be less easily practised by beginners and amateurs than the ordinary ones.

The art of distilling is not only not difficult to learn, but is already in practice in this country in the case of peppermint, sweet birch, sassafras, eucalyptus, and the like. More care and better apparatus would be required for distilling roses and other flowers, but the process is essentially the same. Nor do the grease processes involve any difficulties which may not be overcome by the application of a little American ingenuity and capital. In fact, the production of the raw materials of perfumery might proceed almost at once, so far as the difficulty of the processes is concerned. But can we grow the requisite plants?

That many of the standard perfumery plants will grow in this country needs no proof, and there is no reason to doubt that their fragrance in properly chosen localities will equal that of the same plants in the European centers. In general, success in this line must be looked for only southward, even in dealing with hardy plants, though there may be exceptions to this rule. Cool trade-winds and fogs at flowering time are to be shunned. The natural conditions in Florida and large parts of the other Gulf states seem not very different from those of the south of France, the great center of perfumery-farming in Europe, and in fact the feasibility of successful perfumery-farming in Florida has been demonstrated by actual trial. California has also been the scene of experiments, some of them seeming to promise success as soon as economic conditions admit. A large territory between these two points is available for some lines of the industry.

Among the particular plants to be noticed, the citrus fruits deserve a leading place. Nearly or quite all of the trees of this group, including the sweet, the bitter or Seville, and the bergamot oranges, the sweet and sour limes, the lemon, the citron, and the shaddock, contain valuable perfumes either in the peel of their fruit, or in their flowers, or in their leaves, or in more than one of these. Of the fruit-oils, that of lemon is imported into this country in largest quantity, followed by oil of bergamot, oil of orange—bitter and sweet, oil of limes and "cedrat" or citron oil, the last two in very small quantities, but the cedrat at a very high price. These oils are extracted by expression, the distilled being inferior, though it is asserted that when the "rag," or inner soft layer, is removed, the distilled oil equals the other. The oil of the bitter orange is superior to that of the sweet; the oil of bergamot is far more valuable than either, but can rarely be had in an unadulterated state. The flowers of the orange treated by distillation yield "neroli." The scent of neroli, however, is not that of the flowers, an alteration taking place during the distillation. Orange-flower water, consisting of the condensed vapor of water with a little unchanged oil adhering, affords the true odor of the

flowers. By maceration, likewise, the true floral fragrance is obtained. The abortive flowers which fall from the trees are available for perfumery use, but the flowers are also sometimes picked, presumably with a better result. Besides the product of fruit and flowers, the leaves and young twigs pruned from the sweet and bitter oranges yield to distillation the oil of "petit grain," of considerable though minor value. There is no reason to doubt the perfumery capacity of American orange groves. Indeed it has been asserted that the orange flowers of Louisiana excel in sweetness those of foreign parts. In Los Angeles, California, something has been done toward utilizing the peel, and in Florida a beginning has been made with both peel and flowers, but for the most part these resources are at present suffered to go to waste.

The lemon verbena, *Lippia citriodora* (Fig. 2868), may be mentioned in passing as furnishing an attractive perfume of the citrus order, and as available at least in Florida and California.

The perfumery products of the rose and its allies merit next attention. The value of the importation of attar of roses—to say nothing of rose perfume in other forms—exceeds that of any single citrus perfume, and at the same time the capacity of this country for producing this and the other rose perfumes can scarcely be called in question. The present supply of the European and American markets is derived chiefly from Turkey and from the perfumery region of the south of France. The attar or oil of roses is produced most largely in Bulgaria and parts of other Balkan states as well as in Asiatic Turkey, principally from the damask rose, which may be taken as a form of *Rosa gallica*. A white-flowered rose, *R. alba*, is much grown in the more exposed situations, as it is considered hardier than the red-flowered damask rose. It is very free in bloom and productive of oil, which is, however, inferior in quality. The attar is obtained by distillation, which is there conducted in a crude manner. In the Grasse district (southern France), the rose-water, obtained as explained above, is considered to yield more profit than the attar, which is rather regarded as a by-product of the distillation.

But the best rose perfumes in France are extracted by maceration, finishing with *enfleurage*, processes that secure the true rose odor, which is not altogether represented by attar or rose-water. Rose pomade and its alcoholic extract are perhaps the finest of rose products. What is known as the Provence rose, a hybrid or variety of *Rosa centifolia*, the type to which the cabbage or hundred-leaf rose of old gardens and the moss roses belong, is almost exclusively used in France and also in Germany, where a limited quantity of very fine attar is produced.

The *centifolia* and *gallica* varieties of perfume roses, as well as a hybrid of *Rosa rugosa* under the name of Rose Parfum de L'Hay, have been tried in this country with encouraging results as far as facility of culture, quantity, and quality of perfume-content are concerned, but the economic possibilities of rose-culture here for this purpose are far from being worked out at this time. These varieties are all quite hardy and may, without doubt, successfully be grown over a vast extent of country, though for practical perfume-production the warmer climates, coupled with abundant summer moisture, seem to be needed. Deep fertile and retentive but well-drained clay or loam soils are best adapted for rose-culture, and these may be had in abundance in the Southern and Middle Atlantic states, where the future rose industry of the United States, when it becomes a commercial possibility, may be expected to develop. The luxuriant growth of roses on the Pacific Coast has long attracted attention, but exuberant vegetation does not always imply a rich perfumery-content, and there is a suspicion that the cool fogs of the coast and the hot aridity of the interior

valleys of the Pacific States do not favor perfume-production, however stimulating local conditions may be to vegetative growth; but direct experiments in this connection appear to be lacking.

The centifolia and gallica roses have practically but one season of bloom in this country. They are covered with flowers in May or June, according to the latitude in which they are grown, producing only occasional blooms in the fall, the gallicas being most free in this respect; but the hybrid with *R. rugosa* has a long blooming season, with repeated crops coming on in late summer and autumn. This peculiarity might be of advantage in localities where labor is scarce, as a smaller force of workers could care for the same amount of bloom developing over a longer season. The perfume of the hybrid rugosa is of the most exquisite quality and the yield somewhat greater than of the older types of perfume roses, but there is greater difficulty of propagation, as rugosa varieties are increased only by budding or grafting, while the centifolias and gallicas are freely propagated by means of layers or cuttings.



2868. Perfumery plants: *Iris florentina*, *Jasminum grandiflorum*, *Lippia citriodora*.

The production of high-quality rose-water, rather than attar, appears likely to be more profitable in this country, as the latter requires repeated distillations, or washing out by ether and subsequent evaporation of the menstruum, and realizes a relatively less price in market on account of competition with adulterated imported oils and synthetic imitations.

The type of rose bloom best suited for perfume purposes is semi-double, with large, thick petals that can easily be collected, rather than the more showy varieties with full disks of shorter petals so crowded that they hide the pistils. Many of the latter varieties possess exquisite fragrance and possibly a satisfactory oil-content, but are seldom sufficiently vigorous or free in bloom to offset the added difficulty of manipulation. In a field trial of "Princess Bonnie," one of the most fragrant of American-raised hybrid tea roses, not enough blooms could be collected at a given time for a practical distillation. New varieties will be developed especially adapted to the purpose as interest in rose-perfume production increases, and those with peculiarly attractive odors may become available for the grease process, when not altogether suited for distillation.

The culture of perfume roses and the extraction of their fragrance present no difficulties to American skill,

the main question being that of efficient labor for promptly collecting the blooms during the relatively short productive season. It requires in this country, as abroad, fully 3,000 pounds of fresh rose petals to produce a pound of oil, valued at the present time at \$125, or more if of really high quality. The value of the rose-water represented by this amount of oil would be considerably greater.

The oil distilled from the green parts of the common rose geraniums, *Pelargonium capitatum* (?) and *P. Radula*, resembles in fragrance the oil of roses and is largely used as a substitute for it. Although generally not sold at retail under its own name, it is in itself a legitimate perfume, and its production should be undertaken in this country—only, however, in the South, where the long season admits of three crops of leaves and where the stumps with the soil heaped around them will survive the winter. The largest crop is to be had on rich lowland, but the finest quality is produced on drier and less fertile ground. In France, it is now grown mainly on irrigated land, but the product has to be ameliorated by the admixture of oil from drier locations. The rose geranium is largely grown in Algeria, and in Spain, Sicily, and so on, as well as in France.

Geranium oil, in turn, has its substitutes, among which the oil of lemon-grass from India is conspicuous.

The European sweet violet, *Viola odorata*, affords the finest example of a favorite type of odors quite different from the citrine and the rose. The oil of the violet itself is necessarily so expensive as to be little used. The large amount of flowers required and the amount of hand labor necessary for gathering such small flowers, each growing on a separate stem, are apparently insurmountable obstacles to the extensive use of true oil of violet. Still it may be presumed that there will permanently be a class of buyers willing to pay the necessary cost of so choice a perfume. The violet yields its full fragrance only southward, but it must be grown in partial shade. When labor conditions admit, true violet perfume may be produced in California and in the South. An expert grower of violets has even thought that they might be grown under glass for this purpose.

Of the same general type and in some wise a substitute for violet perfume, is that of *Acacia Farnesiana*, the "cassie" of the French, known in the South as "opopanax." The small yellow balls of flowers are treated by the grease processes, particularly maceration. While not ranked so high as violet, the perfume is in entirely good standing and produced in large

quantities. The flowers, dried with proper care, have a market value for sachets. The opopanax tree grows freely in Florida, is apparently native in Texas, and is suited to the climate of Arizona and southern California. The labor of picking the flowers would be somewhat expensive. Several other acacias are eligible for perfumery use.

To the same group belongs the perfume of orris- or iris-root. It is afforded by the rootstocks of three species of iris, formerly gathered wild and now cultivated near Florence and at other points in Italy. The species are *Iris germanica* (Fig. 1968, Vol. III), *I. pallida*, and *I. florentina* (Fig. 2868), the first of these being our common garden iris, with deep blue flowers, the second a paler-flowered species, the third having white flowers. High authority affirms that the use of the first two species is only a falsification, and, in fact, that the root of *I. germanica* causes serious inflammations. It is certain that the first two are extensively grown; but *I. florentina* alone appears to be much used for distillation. When cultivated, the iris is generally propagated by root-division, the cuttings being placed for the first year in a nursery, afterward set in rows a foot apart. It is grown in stony dry soils on hillsides or mountains. The crop is gathered once in two or three years. The cuticle is scraped from the root, which after being dried in the sun is stored in a dry place for the development of its fragrance. This is wanting in the fresh root, and does not reach its maximum under three years. When distilled, the root yields "orris butter," but it is more largely used in the form of an alcoholic tincture or ground up for sachets. There is no reason why orris-root should not be grown in many parts of this country, but the returns at present are not large.

Another important group of perfumery plants consists of several members of the mint family. Peppermint and spearmint (Fig. 2359, Vol. IV) can hardly be placed in the perfumery class, but lavender, thyme, and rosemary could not easily be spared from the perfumer's resources. Lavender is native on dry slopes in the Mediterranean region, and the oil is most largely produced in the region of the maritime Alps. The plant has been introduced, however, into some of the southern counties of England (Mitcham and Hitchin being the centers), and found to produce there an oil which has commonly been regarded as far superior to the French, and at any rate is different in kind (see *Mentha*). The English lavender is grown in light and well-drained calcareous soils. In well-drained ground, lavender will bear some cold, especially if protected, but profit cannot be looked for far north. Lavender of the French type may be expected to succeed in California out of the reach of the trade-winds, and may perhaps not require irrigation. There are shallow calcareous soils in the "black belt" of the Gulf States which might perhaps yield an oil like the English, and the same may be true of some tracts northward on the Pacific slope. Lavender is treated by distillation, and it is said in England that direct contact with the water yields better results than the application of dry steam. (See, also, *Lavandula*.)

Thyme (chiefly the garden thyme, *Thymus vulgaris*) furnishes a perfume particularly suited to soaps and imported into this country in large quantities. Rosemary has a stimulating property and is an essential ingredient in Cologne water. Both of these could quite possibly be grown, say in California, but might not be able to compete well with the spontaneous product of Europe.

Some notice should be taken, too, of the rather humble group of odoriferous plants belonging to the parsley family, including anise, caraway, and fennel. Not only are the oils of these three (chiefly anise) largely imported but also their seeds (chiefly caraway). Caraway runs wild northerly, fennel has established itself on the lower Potomac, and anise could doubtless be grown, but

there is no reason to expect large profits from these plants.

There are several plants deserving consideration which do not fall into any of these groups. One is the jasmine (*Jasminum grandiflorum* and *J. Sambac*) (Fig. 2868). This furnishes almost the only odor which cannot be imitated by combinations of others. The oil of jasmine is very valuable. The plants can be grown in our warmest regions. The tuberose furnishes another choice perfume and has been very successfully grown for the purpose in Florida and South Carolina. (See *Polianthes*.) The heliotrope (Fig. 1801, Vol. III), jonquil (Fig. 2448, Vol. IV), and mignonette are also to be named. Of a quite different scent from any of these is the oil of bitter almond, so important for fine soaps. This so-called oil is a poisonous compound formed in the process of fermenting the cake of the kernels from which the fixed oil has been expressed. Its production should be considered in our almond-growing regions, especially California.

Several tropical grasses of the genus *Cymbopogon*, including *Cymbopogon Schenanthus*, which yields the previously mentioned lemon-grass oil, are of easy culture in Florida and the Gulf States generally, and doubtless will be largely used in the future for the production of fragrant oils having a wide range of usefulness, especially in the form of combinations for scenting soaps. Those best known are vetiver, *Vetiveria zizanioides*, citronella, *C. Nardus* and the true lemon-grass, *C. citratus*, not possessing the geranium-like odor found in *C. Schenanthus*. With the exception of vetiver, which contains the fragrant principle in the roots, the leaves and flowering parts of the *Cymbopogon* grasses are used for distillation.

Of our native growths there are some which are already utilized as the source of scenting materials. The root of sassafras is or has been distilled in Pennsylvania, Maryland, and Virginia, and in other northern states, and sparingly southward. Wintergreen, *Gaultheria procumbens*, is distilled in small quantity in several eastern states, but has very largely given place to sweet or cherry birch, *Betula lenta*, which yields a similar oil with less expense. The wood of the red cedar, *Juniperus virginiana*, has long been distilled in Germany, and latterly in this country. It furnishes a finer cedar-of-Lebanon perfume than the cedar of Lebanon itself.

Three native plants representing respectively the thyme-like and citrine odors,—widely known as weeds but amenable to cultivation over a great extent of country,—are wild bergamot, *Monarda punctata*, mountain mint, *Pycnanthemum albescens* and Canada fleabane, *Erigeron canadense*. The first two yield oils useful for soaps as well as for the production of thymol, now a valued medicament, while the latter contains a high percentage of limonene that may largely displace turpentine in the manufacture of agreeable varnishes for inside uses.

The root of the wild ginger or Canada snakeroot, *Asarum canadense*, yields a fragrant oil quoted in market reports, and said to be used especially for strengthening other perfumes. The sweet goldenrod, *Solidago odora*, furnishes an oil which has a market standing. The rich odor of the yellow jessamine of the South has been successfully extracted in Florida. The common market perfume of magnolia is doubtless mostly or entirely an imitation, and the same is probably true of *Clethra alnifolia* perfume. The great magnolia, *Magnolia grandiflora*, abounds in the South, but its flowers might be difficult to secure in quantity. *Clethra* is abundant enough in the Atlantic Coast region, but some difficulty might be experienced with it owing to the fact that only a part of the flowers in the raceme open at one time. The flowers of the swamp magnolia or sweet bay, *Magnolia virginiana* or *M. glauca* (Fig. 2298, Vol. IV), should be tried. The spice bush, *Benzoin aestivale*, affords several scents. The sweet

and copious bloom of *Rhododendron arboreum* in the southern mountains has been suggested for treatment. It is to be feared that the delicious odor of the native crab-apples would be too expensive, considering the difficulty of collecting enough petals. The bloom of the wild grape might well be thought of. Many of our plants—these are only examples—will eventually be tried and a few will be found steadily valuable. It is useless to expect commercial success with small and scanty-flowered plants like trailing arbutus, *Epigaea repens*, however pleasing in their natural state.

The production of perfumery oils may be conducted on large farms by capitalists; or a central establishment may contract with individuals for flowers, and other materials; or the business may be conducted coöperatively; or individuals may operate on a small scale in connection with other lines of farming. Some competent women to whom other avenues are closed may find this work available and congenial.

Intending experimenters should seek further information in one or more of the books which are before the public. With regard to methods of extraction, Askinson's "Perfumes and Their Preparation" may be confidently recommended. Sawer's "Odorographia" (especially the first series) is valuable both to the extractor and the grower. Piesse's "Art of Perfumery" will also be found useful on both sides of the subject. Gilde-meister and Hoffman's "Volatile Oils" is also very valuable. Also consult E. S. Steele's article on "Perfumery-Gardening" in the Yearbook of the United States Department of Agriculture for 1898. Vol. XXII, part 2, of the Journal of the Royal Horticultural Society (London, 1898) contains a list of perfumes and plants that yield them, and also a list of books on perfumes.

E. S. STEELE.
W. VAN FLEET.†

PERGOLA. The word "pergola" closely interprets its original meaning: from the Latin "pergula," a projecting roof, shed, or vine arbor, from "pergere," to reach forward or project; and from the Italian "pergola," a grape which remains upon its trellis all winter. From this derivation and use of the word, it will readily be seen how the term has become one of common usage in modern garden design, rightly or wrongly to designate almost any type of arbor or vine-support in the present-day garden. In order to understand the purer and less general meaning of the word, the garden vine-supports may be divided into two kinds or types: (1) treillages, decorative or otherwise, which may broadly be considered as designed in one simple geometric plane, perpendicular to the garden, their dimensions, height, and length being determined only by their use and detail design; and (2) pergolas and arbors, designed or planned in three planes, having height, length, and breadth, and, in brief, being architecturally conceived tunnels over which vines are trained or grown, the arbor and the pergola differing only in the detail of their design.

The pergola is invariably flat-topped, its semi-open roof being formed either by rustic poles or timbers of varying size, laid at right angles to the length of the structure, or by similarly laid but regularly spaced rafters or timbers of definite size and cut, this partially open roof being supported in either case by posts or columns of an architectural character equally and oppositely spaced. In simpler description, the pergola is a horizontal vine-support raised upon piers or columns, each of the latter standing free and independent of the other, the vines being encouraged to lie flat over its top.

The arbor, in distinction from the pergola, is, in its simplest form, a treillage or vine-support of a skeletonized form, with sides and top generally alike, its top, or roof, being flat or curved as its design may determine. In detail, its construction consists usually of regularly and oppositely spaced wooden posts sup-

porting not over-thick strips and rails of the same material, these extending horizontally. Other material than wood is often used in arbor-construction, but the design and character remain generally the same,—a skeletonized tunnel for the support and training of vines over its entire surface. Therefore, while similar in origin and use in the garden, the pergola and the arbor must not be confused in their character and design. The arbor is, in fact, a development of the even earlier-used pergola, which in medieval gardening often became the pleached alley (or alleé), and in the early French and English gardens the very decorative and often complicated tunnel or gallery of treillage.

The pergola is numbered among the oldest pieces of garden architecture extant. The Egyptian used it as a covered walk from one part of his domicile to another, or to his garden house; Pompeii and ancient Rome prove its constant use, Vitruvius, describing the garden attached to the villa of Diomedes, saying, "behind the fish pond ornamented by a fountain, there was a platform over which vines were trained on a wooden framework supported upon six columns of stucco." In Italy, the pergola can be traced through the various transitions of the Italian gardens from those of early imperial times through the medieval, to the architectural or formal gardens of the Renaissance and today. In the great medieval period, the pergola and the cloister were often synonymous in use, differing only in the material of their construction, the latter being largely the outgrowth and development of the former. As early as the beginning of the fifteenth century, the pergola was in common use in France, being found not only in the magnificent gardens of the kings, but as a feature of the smallest town gardens of Paris. Riat, in his most authentic garden history, "L'Art des Jardins," carefully notes and describes the use of the pergola at this time; Hill, one of the earliest of English writers on gardening, in his "Gardener's Labyrinth," published about the middle of the sixteenth century, claims the pergola to be "so winded that the branches of the vine, melon, or cucumber, running or spreading all over, might shadow and keep both the heat and the sun from the sitter there under, and offer him cool and shaded passage." William Horman, in his "Vulgaria," published in 1519, tells us that "alleys in gardens, covered with vines, do great pleasure with the shadow in parchynge heat, and clusters of grapes maketh a pleasant walkynge alley." Thus, in brief, it will be seen that the pergola and its close kin, the arbor, have been used in all time and manner of gardening, the earlier English colonists bringing both to America, where their popularity, especially of late, has been so great as often to cause their degeneration in design and misconception in use.

There is no decorative or useful feature in the garden scheme which has been more inadvisedly used than the pergola. Like our gardening, which has naturally become composite and therefore often impure in taste, so the pergola has become subjected to all manner of diversity in use, material, and design. It can be made an excellent motif and component of a good garden scheme, if properly and carefully considered. Its value is not as a mere floating incident, untied and non-related to some stronger element or to the frame of the garden. It must be given a "tying-together" or corridor value in order best to serve and express its use. The garden should be designed in a manner to call for its use as a covered passage between the house and the garden entrance; or to connect one garden, or part of a garden, with another; or to separate garden from garden, offering substitute for the wall, hedges, or lattice, which might otherwise be used; or allowed to enframe or terminate the garden, a situation in which it may often be used to fine advantage either alone or in combination with a garden house or shelter; but it should not be so designed and placed as to serve merely

thus forming a bell-shaped cup: disk-fls. sticky, the anthers much exerted: achenes villous and ciliate.—There are only 2 known species, both of W. N. Amer. The genus is of little horticultural importance and is offered only by dealers in western native plants. The showy golden yellow fls. are not unattractive.

caudata, Gray. Lvs. opposite, long-petioled, triangular-hastate with crenate or entire margins, the apex and sometimes the basal lobes long, caudate-acuminate: heads many, the fls. conspicuously longer than the involucre. Rocky cañons in the mountains, Colo. to New Mex. and Ariz.—Useful in dry or exposed places.

N. TAYLOR.

PERILLA (said to be a native name in India; by others, a Greek and Latin proper name). *Labiatæ*. Herbs, one of which is sometimes grown for the colored foliage.

Erect, with opposite lvs. and small fls. in whorls of 2 that are aggregated into axillary and terminal simple or paniced racemes: calyx bell-shaped, 5-toothed, much enlarged and gibbous in fr.; corolla short-tubed, the tube not exceeding calyx, limb oblique and somewhat unequally 5-lobed; stamens 4, erect and separate; disk represented by a large gland; style 2-parted.—Two or 3 species, Himalaya region to China and Japan. The plant known in gardens as *P. nankinensis* is distinct by the color of its foliage. The lvs. are a dark wine-purple, with a bronzy luster. These colors are more or less toned with green, especially in young plants. It is an annual herb, growing about 1½ ft. high. It is considerably used in subtropical beds and for the back of ribbon borders. It is sometimes planted next to a dusty miller or other white-lvd. plants for the sake of contrast. The foliage has an odor suggesting cinnamon. In Japan the perilla is of economic importance for the production of oil.

Perillas need a sunny or at least half-sunny position. They thrive under the treatment given half-hardy annuals. Sow the seeds thinly and cover nearly an inch. Avoid planting too closely; leggy specimens are unattractive, and the plant has a tendency to become weedy. The flowers are inconspicuous and produced in autumn. Before the introduction of the coleus, this plant was much used as an ornamental flower-garden plant, but in our warmer summers it is displaced by the more brilliantly colored and free-growing forms of that plant.

frutescens, Brit. (*Öcimum frutescens*, Linn. *P. ocymoides*, Linn. *Méntha perillodes*, Willd.). The typical form has lvs. green on both sides and is worthless for gardens. Annual: lvs. opposite, rarely speckled with brownish purple, only slightly wrinkled, base wedge-shaped or narrow; blade broadly ovate or roundish, pointed or blunt, hairy or not, dentate or variously cut at the margin. In the wild, it is a coarse often shaggy plant, 2-4 ft. high, with lvs. 3-6 in. long, petioles 1-3 in. long; racemes 3-8 in. long; corolla white or reddish, 2 lines long; fruiting calyx about ¼ in. long. Himalayas, Burma, China, Japan. B.M. 2395.—Sparingly run wild. Following are new combinations.

Var. **nankinensis**, Bailey (*P. nankinensis*, Decne. *P. ocymoides* var. *nankinensis*, Voss). Slightly hairy, rarely glabrous: lvs. dark purple-brown, with a bronzy luster; base wedge-shaped (rounded in strong-growing specimens); blade ovate, acute, coarsely and deeply saw-toothed, margin wavy. Seedlings are sometimes green. R.H. 1852:60; 1879, p. 272. Forms of this variety are: (1) Var. **laciniata**, Bailey (*P. laciniata*, Hort. *P. nankinensis* foliis atropurpureis laciniatis, Hort.), has lvs. cut nearly to the middle, foliage undulate, wrinkled or crisped. Colors said to be more intense. Intro. about 1872. P.G. 2:77. (2) **macrophylla**, Bailey (*P. nankinensis macrophylla compacta*, Hort.), is a large-lvd. form characterized by its almost "bell-shaped" form. The lvs. are wavy-fringed. Habit compact. (3) Var. **elätior**, Bailey (*P. nankinensis macrophylla*

elätior, Hort. Benary), is a taller form of var. *macrophylla*. (4) Var. **variegata**, Bailey (*P. nankinensis foliis variegatis*, Hort.), differs in having the foliage spotted with white. (5) Var. **microphylla**, Bailey (*P. nankinensis microphylla nigricans*, Hort.), is a small-lvd. form intro. about 1899.

WILHELM MILLER.
L. H. B.†

PERILOCA (Greek, *around*, and to *twine*; alluding to the twining habit). *Asclepiadaceæ*. Ornamental vines grown for the handsome glossy foliage and the fragrant flowers appearing in summer.

Twining or upright deciduous or evergreen shrubs, glabrous, with milky juice: lvs. opposite, entire, without stipules: fls. in axillary or terminal cymes; calyx 5-lobed; corolla 5-parted, bearing inside at the base a 5- or 10-lobed crown; stamens 5, with very short filaments and with the anthers connected at the apex and villous; style short, with broad stigma: fr. consisting of 2 follicles, containing numerous, small, winged seeds.—About 12 species from S. Eu. to Trop. Afr., China and E. India.

The perilocas in cultivation have dark green and glossy leaves and dull-colored fragrant flowers followed by long and slender pods. *P. sepium* has proved perfectly hardy as far north as Massachusetts and *P. græca* is hardy north to New York, and can be grown even in Canada when trailing on the ground and somewhat protected during the winter. They thrive in any well-drained soil and prefer sunny positions; they are well suited for covering arbors, trelliswork and trunks of trees. Propagation is by seeds or by greenwood cuttings in summer under glass; also by layers.

græca, Linn. SILK-VINE. Deciduous shrub, twining to 40 ft.: lvs. petioled, ovate to oblong-lanceolate, acuminate, dark green and glossy above, 1½-4 in. long and 1-2 in. broad: fls. in loose, long-peduncled cymes, brownish purple inside, greenish at the margin and outside, 1 in. across; corolla lobes oblong, spreading, villous; crown with 5 slender thread-like incurved glabrous appendages: follicles narrow, about 4 in. long. July, Aug. S. Eu., W. Asia. B.M. 2289. B.R. 803. L.B.C. 14:1389. Gn. 34, p. 78.—A vigorous and high-growing climber with handsome dark green and shining foliage remaining unchanged until late in fall. Under the name of *P. angustifolia* a narrow-lvd. form is sometimes cult., which is *P. græca* var. *angustifolia*, Jäg. The true *P. angustifolia*, Labill., is synonymous with *P. laevigata*, Ait., from the Canary Is. and N. Afr., with persistent lvs. and pubescent appendages of the crown.

sepium, Bunge. Fig. 2870. Lower and slenderer than the preceding species: lvs. lanceolate, long-acuminate, dark green and glossy above, paler beneath, 2-3½ in. long and ½-¾ in. broad: fls. in few-fl. cymes, similar to those of the preceding species, but smaller, about ¾ in. across and with revolute corolla lobes: follicles 4-5 in. long. June, July. N. China.

ALFRED REHDER.

PERISTERIA (Greek, *dove*, from the form of the column and wings). *Orchidaceæ*. A group of stately South American pseudobulbous warmhouse orchids.

Leaves large, plicate, unfolding successively: fl.-



2870. *Periploca sepium*.
(×¼)

spikes tall, erect or hanging; fls. nearly globular or cup-shaped, of a waxy texture, with broad concave segms. The genus is distinguished from the related genera *Acineta*, *Lacena*, *Gongora*, and the like, by the curious shape of the labellum and column. The base of the labellum (hypochil) is united with the column by broad wings (pleuridia). The upper part of the labellum (epichil) is movably joined to the hypochil.—Five species, of which 2 are commonly cult.



2871. *Peristeria elata*.—Holy Ghost plant. (Flower $\times \frac{1}{2}$)

The chief factors in growing peristerias are moisture during the growing period, the ideal location being in proximity to water, in a temperature of 65° to 70° F., and a decided rest when growth is completed. The growing medium should consist of two-thirds fibrous sod soil and one-third peat and sand, an addition of dried cow-manure being beneficial. The pots should be well supplied with drainage. When the plant is growing freely, water occasionally with organic fertilizer until the growth is completed. Then reduce the water-supply to induce flowering when the young growth appears. An excellent specimen of *P. elata* in the Missouri Botanical Garden recently produced a flower-spike 3 feet 6 inches high and produced twenty well-formed flowers. From the first appearance of the spike until the last flower opened, covered a period of three and a half months. This noteworthy specimen was grown over a tank of water, in a house of miscellaneous warmhouse plants, and organic manure was given freely during growth. The plant was then transferred to the cactus house to rest, enough water was given to prevent shriveling of the pseudobulbs, until the young growth appeared bearing a well-formed flower-spike: it was again transferred to its former position and watered freely to develop the spike. (G. H. Pring.)

elata, Hook. DOVE-FLOWER. HOLY-GHOST-FLOWER. Fig. 2871. Pseudobulbs 4–5 in. high, bearing several strongly veined lvs. 2–3 ft. high: fl.-st. 3–4 ft. high; fls. in a raceme covering about one-third the length of the fl.-stalk, cup-shaped, creamy white, wax-like and fragrant, 2 in. across; sepals broadly ovate to rotund; petals more delicate; labellum fleshy, broadly obovate, truncate, sprinkled with deep purple; column with large, curious wings, supposed to bear resemblance to a dove. June–Sept. Panama. B.M. 3116. Gng. 5:151. V. 8:163. Gn. 12, p. 153; 30, p. 574; 42, p. 324. R.H. 1876, p. 133; 1877:110.—The labellum and wings of the column are sometimes spotted with purple. Intro. into cult. in 1826.

péndula, Hook. Pseudobulbs ovate-oblong, 4–5 in. high, bearing lanceolate, strongly veined lvs.: scape

pendulous, from the base of the pseudobulb, bearing as many as 20 fls.; fls. globular in outline, $1\frac{1}{2}$ in. across, fragrant, greenish white outside, tinged with rose and thickly dotted with purple within; sepals roundish concave, united at base; petals rather smaller; labellum fleshy, curiously shaped, inclosed within the fl. Guiana. B.M. 3479. G.C. II. 25:116.—Requires tropical treatment, but rarely flowers in cult.

cérina, Lindl. Pseudobulbs oblong-ovoid, up to 3 in. long, 3–4 lvd.: lvs. oblong-lanceolate, up to 1 ft. long: scape pendulous, short, bearing a dense raceme of 6–10 fls.; fls. about 1 in. across, pale lemon-yellow, waxy; sepals and petals broadly ovate, concave; lip 3-lobed, the acute lateral lobes ovate, the midlobe emarginate, inflexed, the margin crisped. Cent. Amer. B.R. 1953.

P. aspera, Rolfe. Pseudobulbs ovoid-oblong: racemes dense, 8–10 fld.; fls. light brownish yellow, densely spotted with reddish brown, the front lobe of lip brownish crimson; sepals and petals elliptic-oblong, obtusish. Venezuela. L. 287.—*P. Humboldtii*, Lindl. = *Acineta*.

GEORGE V. NASH.†

PERISTROPHE (Greek, *peri*, around, and *strophos*, belt; alluding to the involucre). *Acanthaceae*. Greenhouse plants, grown for the bloom.

Erect, branched or loosely creeping herbs or half-shrubby: lvs. entire: fls. solitary or in clusters of 2–3 surrounded by an involucre, in loose cymes or cymose panicles, or distant on slender branches; bracts of the involucre narrow; calyx deeply 5-parted, shorter than the bracts, scarious or hyaline; corolla-tube long, slender, slightly enlarged above, limb deeply bilabiate, the posterior lip narrow, erect, concave, entire or emarginate, lower lip spreading, apex 3-parted; stamens 2, a little shorter than the corolla-lips; anthers 2-celled; sterile stamens none; style filiform: caps. oblong, contracted into a solid stalk.—About 15 species, ranging from Trop. Afr. and India to the Malay Isls., Philippines, and Austral.

The plants are cultivated like jacobinias or justicias, of the same family. Cuttings taken at any time when the wood is soft will root in a warm bed in three to four weeks, after which the potted plants may be removed to a house of lower temperature. They require a rich loam mixed with some leaf-mold, and plenty of air.

speciosa, Nees (*Justicia speciosa*, Roxbg.). Fig. 2872. The plant erect, spreading and branched, becoming 2–3 ft. high: lvs. opposite, petioled, ovate-acuminate, smooth: fls. in clusters of 2–3 on slender branches, violet-purple, $1\frac{3}{4}$ in. long. Blooms for a long period in winter. India. B. M. 2722. L.B.C. 20:1915. B. 2:74. Gn. 73, p. 42.—A pot-plant of bushy compact habit when well grown. Good for the window. Usually thrives best in partial shade.

angustifolia, Nees. Plant low, erect, very much branched:



2872. *Peristrophe speciosa*. ($\times \frac{1}{2}$)

branches nearly horizontal, pubescent above: lvs. lanceolate, pointed at both ends: fls. sparse, in terminal cymes, rose-colored. Flowers freely. Java. Var. *atrea variegata*, Hort., has the center of the lvs. variegated with yellow. Useful for vases and baskets.

HEINRICH HASSELBRING.

PERIWINKLE: *Vinca*.

PERNÉTTYA (after A. J. Pernetty, 1716-1801; he accompanied Bougainville on his voyage and wrote "A Voyage to the Falkland Islands"). *Ericaceae*. Ornamental plants grown chiefly for their attractive variously colored and profusely produced berries, also for their neat evergreen foliage and white or pinkish flowers.

Evergreen shrubs: lvs. alternate, short-petioled, small, usually serrate: fls. axillary, usually solitary on slender nodding pedicels, rarely in racemes; calyx 5-parted; corolla urceolate, with short 5-lobed limb; stamens 10, the anthers 4-awned at the apex: fr. a 5-celled many-seeded berry.—About 25 species from Mex. to the Magellan region, mostly in the mountains, and 1 species in Tasmania and New Zeal. Allied to Gaultheria, but the calyx not enlarged and rarely fleshy after flowering.

The pernettias are low much-branched shrubs with dense and small evergreen leaves and small nodding flowers, followed by very decorative berries varying in color from white to purplish black or bluish black and remaining on the branches all winter. These exceedingly pretty shrubs are great favorites in England, but are little known in this country. *P. mucronata* and *P. angustifolia*, the hardiest, are probably hardy in sheltered positions as far north as New York. They are well suited for rockeries and borders of evergreen shrubberies and also make very handsome pot-plants. They grow best in a peaty and porous moderately moist soil and prefer sunny positions, but seem to grow almost as well in any other well-drained soil; in shade they will not fruit so profusely as in the full sun. Propagation is by seeds or by cuttings of half-ripened wood in summer under glass; also by means of layers and suckers.

mucronata, Gaud. (*Arbutus mucronatus*, Linn. f.). Much-branched shrub, to 2 ft., with glabrous or sparingly hairy branches: lvs. almost 2-ranked, ovate to ovate-oblong, spiny-pointed, serrate, dark green and shining above, glabrous, $\frac{1}{2}$ – $\frac{3}{4}$ in. long: fls. solitary, nodding, globose-ovoid, white or slightly tinged pink, about $\frac{1}{2}$ in. long, on pedicels 2–3 times as long as the fl.; stamens longer than the ovary: fr. white to dark purple, $\frac{1}{2}$ – $\frac{1}{2}$ in. across, red in the typical form. May, June. Magellan region to Chile. B.M. 3093; 8023. B.R. 1695. L.B.C. 19:1848. Gn. 23:389; 59, p. 41. Gt. 34, p. 214. G.M. 40:811. M.D.G. 1898:397.—Many varieties (*P. hybrida*, Zabel), partly originated by hybridizing with the following species are cult. in English and Dutch nurseries, mostly differing in the color of the fr., which is usually indicated by the name of the variety, as vars. *alba*, *atropurpurea*, *coccinea* (F.M. 1879:339), *lilacina* (F.M. 1879:339), *nigra*, *purpurea* (F.M. 1879:339), *rosea*, *sanguinea*, Hort. Also *P. Drummondii*, *P. Cummingii*, *P. speciosa*, *P. floribunda* (G.C. II. 18:649 and III. 28:465) belong here. *P. mucronata* and its varieties are among our most ornamental fruiting shrubs in wintertime, when they are loaded with bright-colored berries contrasting well with the dark glossy foliage; they are also very handsome in spring when covered with their numerous white fls.

angustifolia, Lindl. (*P. mucronata* var. *angustifolia*, Nichols.). Closely allied to the preceding: lvs. lanceolate to linear-lanceolate, usually arched backward, smaller, not spiny-pointed: fls. somewhat smaller, on slender pedicels; anthers twice as long as filaments; style as long as ovary. May, June. Chile. B.R. 26:63.

B.M. 3889.—The plant usually cult. under this name is a narrow-lvd. form of the preceding species.

P. ciliata, Don. Spreading shrub: lvs. oblong to narrow-oblong, serrulate, $\frac{1}{2}$ –1 in. long: fls. solitary, ovate, white: fr. almost black. Mex.—*P. ciliata*, Lindl., not Don. J.H.S. 1851, p. 268. G.C. II. 10:89, and III. 28:463, belongs probably to *P. furena*.—*P. furena*, Klotzsch. Upright shrub: lvs. ovate to ovate-lanceolate, ciliate, to $1\frac{1}{4}$ in. long: fls. in axillary, secund, rather dense racemes: fr. brownish red. Peru, Chile. B.M. 4920.—*P. Pénlandii*, DC. Similar to *P. mucronata*, but lvs. not spiny-tipped: fr. dark purplish blue, with the calyx-lobes fleshy. Venezuela to Chile. B.M. 6204.—*P. phillyreaefolia*, DC. Similar to *P. mucronata*: branches sparingly hispid: corolla ovate, pubescent inside; anthers twice as long as filaments. Peru, Chile.—*P. pilosa*, Don (*Arbutus pilosa*, Graham). Prostrate shrub, with densely hispid branches: lvs. elliptic-oblong, serrate, to $\frac{3}{4}$ in. long: fls. ovate, white, solitary. Mex. B.M. 3177.—*P. rupicola*, Phil. Closely allied to *P. mucronata*: lvs. smaller, with few minute teeth: fls. on pedicels scarcely twice as long as fl.; stamens not exceeding the ovary. Chile. Sometimes cult. as *P. mucronata*.—*P. rupicoloides*, Schneid. Supposed hybrid of the preceding species and *P. mucronata*.

ALFRED REHDER.

PERÓVSKIA (after B. A. Perovski, about 1840, governor of the Russian province Orenburg). Also spelled *Perovskia*. *Labiatae*. About 4 herbaceous or shrubby plants from Cent. Asia, allied to *Salvia*, with opposite serrate or pinnatifid lvs. and rather small heterostylous fls. in whorls usually arranged in terminal spikes: calyx tubular-campanulate, 2-lipped; corolla 2-lipped, the upper lip unequally 4-lobed, the lower undivided; 2 sterile and 2 fertile stamens, the latter with 2 distinct contiguous anther-cells: fr. consisting of 4 ovoid-oblong nutlets inclosed by the calyx. The only species in cult. is *P. atriplicifolia*, Benth. Shrub, to 5 ft., erect, of aromatic sage-like odor when bruised: sts. hoary-tomentose: lvs. ovate-lanceolate to lanceolate, acutish, unequally and coarsely serrate, at first pubescent, finally nearly glabrous, glandular, $1\frac{1}{2}$ –2 $\frac{1}{4}$ in. long: fls. blue, about $\frac{1}{2}$ in. long, in 2–6-fld. remote whorls arranged in slender spikes forming terminal panicles 1–1 $\frac{1}{2}$ ft. long; calyx densely villous. Aug., Sept. Afghanistan to W. Himalayas and W. Thibet. B.M. 8441. R.H. 1905:344. G. 33:511; 36:539.—Handsome shrub, valuable for its late blue fls. forming a pleasing contrast with the silvery gray sts. Not quite hardy N., but if killed partly back, it sends forth young shoots which will flower the same year. It prefers sunny positions and well-drained loamy soil. Prop. is usually by greenwood cuttings, which grow readily in summer under glass.

ALFRED REHDER.

PERSEA (ancient Greek name of an Egyptian tree with sweet fruit; derivation unknown, probably from Perseus). *Lauraceae*. Woody plants sometimes grown for ornament; and one of them yields the avocado, one of the best of the semi-tropical fruits.

Leaves alternate, entire: fls. small, hermaphrodite, usually in panicles; corolla wanting, the calyx deeply 6-parted; stamens usually 12, in 4 series, with one series sterile; ovary sessile and tapering into a slender style bearing a simple stigma.—Shrubs and trees distributed throughout the tropics and subtropics, most of the species being confined to S. Amer., but one coming from the Canary Is. and a few from S. E. Asia. As defined by Bentham & Hooker, the genus contains about 100 species, but Meissner (DC. Prodr. 15, pt. 1, 43) distributes some of the species in other genera and retains only 50 in *Persea*. Mex. in his monograph on the American *Lauraceae* (Jahrb. Königl. Bot. Gart. 1889, 5, 135), describes 47 American species. *P. gratissima*, the avocado, widely cult. throughout Trop. Amer. and elsewhere for its fr., is the only species of great economic importance. Others are of ornamental value, and may prove useful as stocks upon which to bud or graft the avocado, although experiments have not been very encouraging up to the present. *P. Borbonia* grows naturally as far north as N. C.; *P. indica* is now and then seen in cult. in Fla. and Calif. Some of the Cent. American types referred to *P. gratissima* seem distinct, and may be found to constitute good species.

A. *Outer calyx-lobes distinctly shorter than the inner.*

Borbônia, Spreng. (*P. carolinensis*, Nees). **RED BAY**. **BULL BAY**. Tree, reaching 40 ft., with smoothish branches: lvs. 2-3 in. long, oblong to lanceolate-oblong, glabrous and deep green above, glaucous beneath: fls. pubescent, the peduncles of the clusters shorter than the petioles: fr. a small blue drupe. Woods, N. C. to Fla.—A handsome evergreen, with wood useful for cabinet work and other purposes.

AA. *Outer calyx-lobes equaling the inner, or very nearly so.*

indica, Spreng. Handsome tree, with elliptic-oblong or lanceolate-oblong attenuate-acute glabrous lvs., 3-8 in. long: panicle 3-6 in. long, the peduncles compressed, and the branches 3-5-fld., the fls. white and $\frac{1}{4}$ in. long: fr. scarcely fleshy. Canary Is., Madeira, and the Azores.

gratissima, Gaertn. f. (*P. americana*, Mill.). **AVOCADO**. **ALLIGATOR PEAR**. **AHUACATE**. **AGUACATE**. **AVOCAT**. **AVOCATO**. **ABACATE**. Fig. 2873; Figs. 445, 446, Vol. I. A large tree, commonly with broad crown up to 60 ft.: lvs. oblong-lanceolate or elliptic-lanceolate to oval or



obovate, 4-10 in. long, 2-6 in. broad, apex acute or shortly acuminate, sometimes almost blunt, the base acute to truncate, frequently rounded, surface glabrous above, usually somewhat glaucous with the venation prominent below; petiole $\frac{1}{4}$ -2 in. long, canaliculate above: fls. shortly pedicellate, in broad compact panicles at the ends of the young branchlets, about $\frac{1}{2}$ in. across, greenish, the calyx-lobes oblong-lanceolate, acute, slightly concave, finely pubescent; fertile stamens 9, in 3 series, each stamen of the inner series bearing just above its base 2 oval flattened orange-colored glands; filaments slender, finely hairy, the anthers oblong-ovate, dehiscent by 4 valves hinged distally, the 2 outer series dehiscing extrorsely, the inner series with the 2 distal valves extrorse and the proximal pair introrse; staminodes 3, flattened, orange-colored; ovary ovate-elliptic, the style slender, attenuate, finely pubescent: fr. a large fleshy drupe, commonly pyriform, ovate or spherical, 2-8 in. long, green, maroon or purple in color, the epicarp membranous to thick and woody, mesocarp soft, yellow, and buttery; seed 1, large, conical to oblate, inverted, exalbuminous, with 2 thin seed-coats often distinct, reticulated. Certainly indigenous in Mex. and Cent. Amer., extending perhaps to N. S. Amer.

The avocado is cultivated commercially in Florida and California, as well as in other parts of tropical America. See *Avocado*. Several distinct forms are known in cultivation, some of them having been considered botanical varieties by certain botanists. The horticultural varieties grown in the United States are

PERSIMMON

generally grouped into three types, which may be distinguished as follows:

A. *Lvs. anise-scented: skin of fr. thin and soft.*

1. Mexican type

AA. *Lvs. not anise-scented: skin of fr. thick.*

B. *Surface of fr. usually smooth; skin leathery, usually not more than $\frac{1}{16}$ in. thick; seed-coats frequently distinct, the outer one adhering to wall of seed-cavity; cotyledons often rough.*

2. West Indian type

BB. *Surface of fr. usually rough or warty; skin brittle, granular, $\frac{1}{8}$ - $\frac{1}{4}$ in. thick; seed-coats adhering closely to the nearly smooth cotyledons.*

3. Guatemalan type

Occasional forms will be found which are difficult to classify by the above key. Especially is this true of the Guatemalan type, of which there are several varieties in California with the skin no thicker than in some varieties of the West Indian type, and nearly as smooth. These can usually be distinguished, however, by the character of the seed and its coats. Solano and Blakeman may be mentioned as smooth-skinned examples of this class. Trees of the Guatemalan type usually have darker-colored foliage than those of the West Indian, and ripen their fruit from January to April, while the West Indian ripens from July to November. The Guatemalan type is considerably the hardier of the two. Both are greatly exceeded in hardness by the Mexican type, which has been known to withstand temperatures of 18° to 20° without serious injury. Chappelow, Ganter, and Harman are varieties of this type well known in California, where they originated. This type is exceedingly common in northern Mexico; the Guatemalan type is found in southern Mexico (whence are derived many of the varieties cultivated in the United States), Guatemala, and doubtless in other Central American states. The West Indian type is the commonest one in Florida, Cuba, and the West Indies in general, and on the eastern coast of South America. The well-known Florida varieties, Trapp and Pollock, are representatives of it.

P. drymifolia, Cham. & Schlect., is now considered to be a form of *P. gratissima*; it is the type with anise-scented lvs. and small, thin-skinned frs. described above as Mexican. Mez recognizes it as a botanical variety, and describes it along with another variety, *P. gratissima* var. *Schiediana*, also indigenous to Mex.—The hardy avocado or yaa of San José, Costa Rica, has been referred by Wercklé to *P. frigida*, Lind., but this name is of doubtful validity. The fr. is figured by Collins (Bull. 77, Bur. Pl. Ind.), and is said to be of possible value for hybridization with more tender species. It is spherical, about 3 in. diam., with a very large seed.—*P. lingue*, Nees, and *P. Meyeniana*, Nees, are two species which have recently been intro. to the U. S. from Chile.

F. W. POPENOE.†

PÉRSICA: *Prunus*.

PERSICÁRIA: *Polygonum*.

PERSIMMON. Interesting and valuable edible fruits.

Of edible persimmons, two distinct types are grown in this country,—*Diospyros virginiana*, the native species, and *D. Kaki*, the Chinese-Japanese species, known as the kaki. The latter is much the more improved, and is the source of the commercial persimmons. See *Diospyros*. Other species have been introduced, but are yet under experiment (cf. "Yearbook, United States Department of Agriculture," 1911, page 416).

The native persimmon.

The American persimmon (*Diospyros virginiana*) is found wild in most of the southern states and as far north as 38° latitude. It will thrive and ripen its fruit, however, as far north as Rhode Island and the Great Lakes. The fruit is little known except to those who live in localities in which it grows wild, and even there

but little attention has been given to its cultivation and improvement. The tree is usually of small size when grown in the open ground, reaching a height of 20 to 30 feet; when grown in the forest, it often reaches a height of 60 to 80 feet; and in the rich alluvial river bottoms, from 2 to 3 feet in diameter. In exceptional cases, it may attain still greater size, even to 7 feet in circumference and 125 to 130 feet high ("Journal Heredity," November, 1915). The wood is hard and elastic, and very durable when used for inside work but it will rot quickly when placed under ground.

The fruit is subglobose and ranges in size from $\frac{1}{2}$ to 2 inches in diameter, depending largely on the number of seeds which it contains, although seedless varieties an inch in diameter are sometimes found. The fruit has a very disagreeable astringent quality when green, but this disappears in most varieties when it becomes fully ripe. The date of ripening in the central states varies from August 1 to December 1. The old notion that this fruit must be subjected to the action of frost before it becomes edible is erroneous; many of the very best varieties ripen long before the appearance of frost, while others never become edible, being so exceedingly astringent that neither sun nor frost has any appreciable effect on them.

The persimmon is readily propagated from seeds, which should be procured in autumn or early winter and planted in the same way as peach pits; but as the seedlings, especially from cultivated varieties, cannot be relied upon to reproduce themselves, they should be budded or grafted when two or three years old. This should be done in the spring as soon as the bark will slip freely. Ordinary shield-budding works well; also annular- or ring-budding, patch-budding, and chip-budding. Large trees may be cleft-grafted, and small shoots or stocks may be whip-grafted.

This tree is more difficult to transplant successfully than almost any other kind of fruit. If too much of the long tap-root is cut off, the tree will be sure to die. Transplant in the autumn, cut back most of the top, but preserve as much of the root as possible, and plant in a deep well-prepared soil. The persimmon will do fairly well on almost any land not too wet, but it will give good results if planted on a rich warm soil, well exposed to the sunlight, and kept well tilled for the first few years after planting, until it becomes adapted to its new surroundings. The orderly growing of persimmon trees in nurseries will remove much of the difficulty in establishing the plantation. The tree and fruit are little attacked by insects and fungous diseases.

The trees should be planted in the orchard 2 or 3 inches deeper than they stood in the nursery. The trees may be kept low-headed so that the fruit can be picked by hand; in this case, they may stand 16 to 20 feet apart each way. If the fruit is not to be hand-picked but gathered as it falls and size and quality are not so important, the trees may stand at about one-half these distances. As the roots run deep, the plantation is adapted to other crops until the tree require the space.

Several chance seedlings of superior size or quality have received names. They are small fruits, yellow or reddish in color, about $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter. Some of the forms are shown in Figs. 2874 and 2875.

For a general horticultural account of the native persimmon, see W. F. Fletcher, Farmers' Bulletin No. 685, United States Department of Agriculture (1915), from which most of the following descriptions of varieties are taken.

Boone (Daniel Boone).—Origin Indiana, where it ripens during October and November; form roundish oblate, size medium, color yellow, with a dull bluish in the sun; skin rather tough; seeds numerous; flavor sweet but not rich; quality good.

Burrier.—Origin central Kentucky, where it ripens rather early; form oblate, size medium, color yellow; practically seedless; flesh soft; quality very good.

Delmas.—Origin Scranton, Mississippi, where it ripens during October and early November; form roundish oblate, size medium

to large, color reddish yellow; skin thin and tough; seeds numerous; flavor sweet and rich; quality very good.

Early Bearing.—Introduced from Cartersburg, Indiana, where it ripens early in October; form round-ovate, size medium, color dull yellow; quality good.

Early Golden.—Origin Illinois, where it ripens in September; form oblong, size medium to large, color yellow; skin thin; seeds few, flavor sweet; quality very good.

Golden Gem (Fig. 2875).—Introduced from Borden, Indiana, where it ripens from August to October; form roundish oblong, size medium to large, color dark orange to red; seeds few, flavor rich and sweet; quality good.

Hicks.—Origin Washington County, Indiana, where it ripens in October; form roundish oblate, size medium to large, color dark red; skin thin and tender; seeds few, flavor rich; quality very good.

Josephine (American Honey, Honey) (Fig. 2876).—Origin near Bluffton, Missouri, where it ripens in September; form roundish oblate, size medium, color bright yellow, changing to pale translucent; skin tough; seeds few, flavor sweet and rich; quality good.

Kansas.—Introduced from Missouri, where it ripens in September; form roundish oblate, size rather large, color yellow splashed with red; flavor rich; quality very good.



2874. The native persimmon, *Diospyros virginiana*. ($\times \frac{1}{4}$)

Marion (Fig. 2875).—Original tree found near Fulton, Missouri, where the fruit ripens in October; form roundish oblate, size large, color dull red; skin rather tough; seeds few; quality good though less rich than some other kinds.

Miller (Fig. 2875).—Origin Jackson County, Missouri, where it ripens in September; form roundish oblate, size large, color reddish yellow, translucent; skin tough; seeds rather numerous; flavor sweet; quality good.

Ruby (Little's Ruby) (Fig. 2875).—Introduced from Cartersburg, Indiana, where it ripens during September and for some time later; roundish oblate, small to medium, yellowish red, shading to deep red; skin tender; seeds few, flavor sweet; quality very good.

Shoto.—Introduced from Danville, Indiana, where it ripens during October; form oblong-ovate, size large, color dull yellow, blushed in the sun; skin rather tough; seeds few; quality very good.

Smeech.—Introduced from Pennsylvania, where it ripens during October and November; form roundish oblate, size medium, color dull yellow, splashed with red; flavor rich and sweet; very good.

The kaki.

The Japanese persimmon (*Diospyros Kaki*) is considered by the Japanese as their best native pomological product. Although cultivated in the south of France for more than ninety years, there is no record of its successful introduction into the United States previous to about 1870. Trees were first sent to California and subsequently to Augusta, Georgia, but owing to defective roots and long delay in transit, the first and second shipments proved a failure, and not until 1876 came the first success with a few trees. All early impor-

tations of trees grown in Japan consisted of trees of small sizes with long tap-roots and no laterals; and probably the stocks on which they were grafted were not adaptable to this country. American enterprise, however, remedied this, as nurseries were established near Yokohama and well-grown trees of the best varieties were exported to the United States. Experiments were made in the South by grafting upon native stocks. This proved successful when the graft was inserted upon the collar of the root, 3 to 4 inches below the surface of the soil. The United States Department of Agriculture received a large quantity of trees from Japan about 1878 or 1879, and fearing that the winter of Washington might prove too cold the trees were sent to Norfolk, Virginia, where many bore fruit the following year. The first fruiting of which there is any record was at Augusta, Georgia, in 1879, upon trees grafted upon native seedlings growing in the forest.

The kaki, or Japanese persimmon, is a fruit for the cotton-belt. However, as regards the hardness of the

those imported from Japan. Inasmuch as the native stock is used, the range of adaptation as to soils and similar conditions is very great. As a stock, *Diospyros Lotus* is adapted to the drier parts of the West, where *D. virginiana* does not succeed. *D. chinensis* will probably be a good stock, but has not yet been tested in this country.

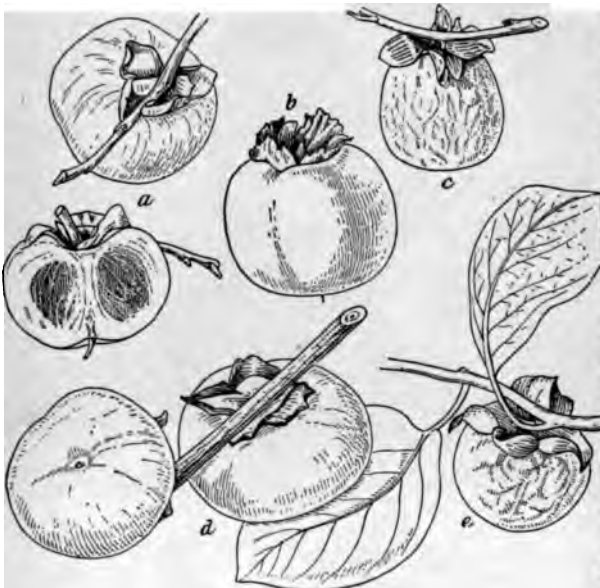
One of the great drawbacks in the cultivation of the Japanese persimmon has been the dropping of the flowers, so that trees and plantations may remain barren. Recently this has been shown to be due to lack of pollination (see Hume, "Proceedings of the Society for Horticultural Science," 1913). A constantly staminate variety is now on the market, the Gailey, which, if planted one tree to seven or eight trees of sterile varieties, will insure a crop so far as pollination is concerned. The Tane-Nashi, however, is self-fertile. It is to be expected that the subject of sterile and fertile varieties, and of inter-pollination, will now receive much attention, with considerable change in the practice of persimmon-growing.

Another difficulty is the great variation in fruits in the same variety or even on the same tree, in shape, size, and other characters. While the cause of all this variation has not been determined, it is known that much of it is eliminated by the good inter-pollination of which we have spoken. Hume writes: "All varieties of Japanese persimmons so far studied are light-fleshed when seedless but certain varieties always show a dark area in the flesh when seeds are present and others are always light-fleshed even when seeds are present. Both dark- and light-fleshed fruits may occur on the same tree. The physiological causes which underlie the changes in color of the flesh are not understood, and offer an interesting field for investigation."

In color, size, and surface texture, the Japanese persimmons somewhat resemble ripe tomatoes. They are now frequently seen in the northern markets. Some of the varieties ship well. Many persons do not like them at first, largely because of the very soft flesh and their sweetness, but the quality is good, it varies much in the different varieties, and the fruit is certain to find increased demand. It is eaten out of hand.

Some of the varieties ripen in August, some in November, and others intermediate between these dates. It requires some experience to determine just when the fruit has reached the proper stage to be marketed, and this varies with the different varieties. Some of the varieties have dark flesh, others light flesh, still others a mixture of the two. The light and dark flesh differ radically in texture and consistency, as well as appearance, and when found in the same fruit are never blended, but always distinct. The dark flesh is never astringent; the light flesh is astringent until it softens. The dark-fleshed fruit is crisp and meaty, like an apple, and is edible before it matures. Some of the entirely dark-fleshed kinds improve as they soften. The light-fleshed kinds and those with mixed light and dark flesh are very delicious when they reach the custard-like consistency of full ripeness. In some, the astringency disappears as the fruit begins to soften; in others, it persists until the fruit is fully ripe. The round-shaped varieties usually ripen first, the oblong are likely to last and keep the longest; these latter should be slowly house-ripened to remove the slight astringency inherent to these varieties.

The market value of the fruit is at present more or less uncertain. A large proportion of the fruit-eating people of the North do not yet know what a fine fruit the Japanese persimmon is. The fruits have to be shipped while hard and allowed to ripen after reaching destination. Commission men are likely to sell them and the public to eat them—or attempt to do so—a week or two ahead of the proper stage of ripeness; hence the Japan persimmon in its best condition is yet comparatively little known. In Japan, the dried fruit, somewhat like a dried or cured fig, is much esteemed.



2875. Native persimmons: a, Josephine; b, Marion; c, Golden Gem; d, Miller; e, Ruby. (X 1/2)

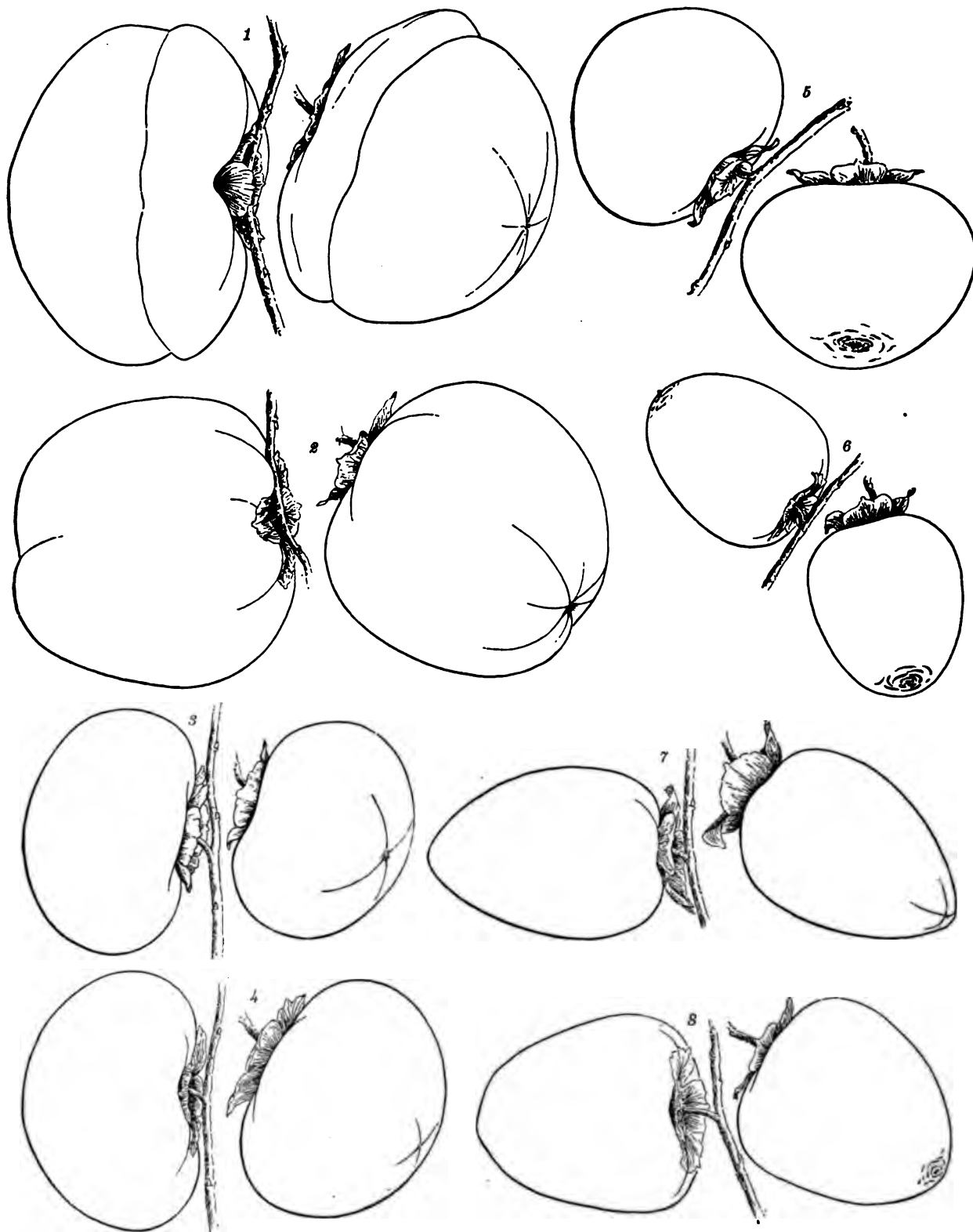
Japanese persimmons, experience demonstrates that some varieties are more resistant to excessive cold than others; but few can withstand a temperature of zero; and as a rule they are more successful below the 32d degree of latitude than farther north. Many seedlings have been produced that seem to have increased frost-resisting powers. Instances are reported in which some of these trees have withstood the winters of east Tennessee. By successive sowing of seeds from these harder seedlings we may look for a race of trees that will be adapted to the middle sections of the United States. There is a probability, also, that importations from the north of Japan and China may considerably extend the range northward in this country. Some varieties have succeeded in central Virginia and Kentucky. Attempts to cross with the native species have so far been unsuccessful.

The best method of propagating Japan persimmons is by collar-grafting upon seedlings of the native species (*Diospyros virginiana*), which are grown either by planting the seed in nursery rows or transplanting the young seedlings from seed-beds early in the spring. The seedlings can be budded in summer, and in favorable seasons a fair proportion of the buds will succeed. Thus propagated, the trees seem to be longer-lived than

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2876. Kaki, or Japanese persimmon, in various forms as grown in Florida. 1, Tamopan; 2, Hyakume; 3, Fuyugaki; 4, Triumph; 5, Boufarik (said to be *Diospyros chinensis*); 6, Galley; 7, Teuru; 8, Tane-Nashi. (\times about $\frac{3}{4}$)

There is a great difference also in the habit of growth and foliage of the varieties. All have broad and shiny simple leaves. Some varieties make a growth of 5 to 7 feet the first year from graft, and at ten years form a tree 10 feet in height. Others assume a dwarf compact habit and seldom grow above 5 to 6 feet in height; this class is more precocious in reaching the bearing age than the taller-growing sorts, and is also likely to overbear. It is not uncommon for a three-year-old tree to yield several hundred perfect fruits. Thinning the fruit as soon as set in early summer will prevent an early failure of the tree.

Trees thrive in any soil in which the native species grows, but usually fail in wet soils. They respond well to good care and treatment, and yet they thrive with less attention than is required by most other fruits. The insects and diseases are few. In the orchard, they are set about 15 to 20 feet apart, except for very dwarf kinds. The general culture is the same as for other fruits.

Some of the varieties of kaki, now known in this country, are as follows:

Bennett.—Of medium size, measuring $2\frac{1}{4}$ by $2\frac{1}{4}$ inches in cross-section; fruit almost quadrangular-conical, the sides often deeply creased, basin shallow, fairly regular; calyx depressed; apex rounded to a rather blunt point, marked by a brown tip; color deep orange-red. Seedless, owing to lack of pollination. A remarkable fruit, noteworthy for its hardness; the original tree is a seedling some twenty years old standing in the yard of Dr. C. D. Bennett, Newark, New Jersey.

Boufari (Fig. 2876).—Size medium, $1\frac{1}{2}$ by $2\frac{1}{4}$ inches; shape round-ovate to ovate, apex rounded, slightly depressed, the remains of the pistil set in the depression, base rounded, with obtuse shallow rounded cavity; color yellowish green, the skin greasy, slightly sticky, covered with rather rusty colored hairs which are most abundant about the apex; calyx broken up and reflexed; stem short, rather stout; cells eight, pith open, seedless; flesh light-colored, very astringent before ripening and with strong odor of jimson weed.

Costata.—Medium size, conical, pointed, somewhat four-sided; diameter $2\frac{1}{4}$ inches longitudinally and $2\frac{1}{4}$ inches transversely; skin salmon-yellow; flesh light yellow, dark flesh and seeds occurring seldom, astringent until ripe, then very fine; a good keeper. Tree distinct; a rapid, upright grower; foliage luxuriant; the most ornamental of all the varieties mentioned.

Fuyugaki (Fig. 2876).—Size medium large, measuring 2 by $2\frac{1}{4}$ inches to $1\frac{1}{2}$ by $2\frac{1}{4}$ inches; color deep orange-red; oblate in form, very smooth, sometimes quartered with four slight creases from the top, apex rounded, very slightly depressed with remains of style persisting, basin very smooth, regular, shallow, calyx reflexed in the ripe fruits; skin thin, tough, smooth; flesh firm, meaty when ripe, light-colored, of a deep carrot-orange; close examination shows the presence of minute widely scattered dark specks; taste sweet, of fine flavor and quality; seeds present, slightly curved along the inner face, the back rounded, brown-shiny, $\frac{1}{4}$ inch long by $\frac{1}{4}$ inch broad by $\frac{1}{8}$ inch thick. An excellent fruit and a decided acquisition.

Gailey (Fig. 2876).—Recommended as a pollinizer, not for its fruit, although the latter is good though small; fruit oblong-conical with a rounded apex and a small sharp point, dull red with pebbled surface; flesh meaty, firm, and juicy.

Hachiya.—Very large, oblong, conical, with short point; very showy; diameter $3\frac{1}{4}$ inches longitudinally and $3\frac{1}{4}$ inches transversely; skin dark, bright red, with occasional dark spots or blotches and rings at the apex; flesh deep yellow, sometimes having occasional dark streaks, with seed, astringent until ripe, then very fine. The largest and handsomest of all. Tree vigorous and shapely; bears fairly well, but is not so prolific as some of the other varieties.

Hyakume (Fig. 2876).—Large to very large, varying from roundish oblong to roundish oblate, but always somewhat flattened at both ends; generally slightly depressed at the point opposite the stem; diameter $2\frac{1}{4}$ inches longitudinally and $3\frac{1}{4}$ inches transversely; skin light buffish yellow, nearly always marked with rings and veins at the apex; flesh dark brown, sweet, crisp, and meaty, not astringent; good while still hard; a good keeper; one of the best market sorts. Of good growth and a free bearer.

Miyotan.—Round or slightly oblong, $2\frac{1}{4}$ inches diameter; average weight, five and one-half ounces; slightly ribbed; deep orange-red; flesh usually deep brown-red, but bright red- or half red- and half brown-fleshed specimens are often produced upon the same tree the results of cross-fertilization by other varieties. Tree of medium or dwarf growth; exceedingly prolific. Fruit keeps very late. The brown-fleshed specimens are edible while solid, and as early as October 1.

Okame.—Large, roundish oblate, with well-defined quarter marks, point not depressed; diameter $2\frac{1}{4}$ inches longitudinally and $3\frac{1}{4}$ inches transversely; skin orange-yellow, changing to brilliant carmine, with delicate bloom and waxy, translucent appearance; the most beautiful of all; light, clear flesh when ripe, with light brown center around the seeds, of which it has several; loses its astringency as soon as it begins to ripen; quality fine. Tree vigorous and good bearer.

Ormond (Boetrom Vining).—Small to medium, oblong, with a tapering pointed four-furrowed apex and rounded base, the large

calyx strongly reflexed; surface deep bright red, carrying a thin bloom, the skin thin and tough; flesh orange-red, becoming very soft when ripe. December in northern Florida, long-keeping.

Taber No. 23.—Medium, oblate, flat or depressed point; diameter $1\frac{1}{4}$ inches longitudinally and $2\frac{1}{4}$ inches transversely; skin rather dark red, with peculiar stipple marks; flesh dark brown, sweet and not astringent; seedy; good. Prolific.

Taber No. 129.—Medium, roundish, flattened at base; has a small but well-defined point at the apex; diameter about $2\frac{1}{4}$ inches both ways; skin dark yellow-red, with peculiar roughened surface, somewhat resembling alligator leather in appearance and markings, except that the marks are usually very small and uniform; flesh light brown, crisp, sweet, meaty, free from astringency; excellent; a good keeper and shipper.

Tamopan (Fig. 2876).—Imported recently from China, and known as the Chinese Grindstone persimmon; fruit perfectly seedless, not astringent and may be eaten when green and hard; large (3 to 5 inches diameter), sometimes weighing more than one pound, broadly oblate and constricted all the way around below the middle so that it has a turban-like shape; color bright orange-red, the skin tough and rather thick; flesh light-colored, astringent until ripe, excellent in quality; tree strong and upright.

Tane-Nashi (Fig. 2876).—Large to very large, roundish conical, pointed, very smooth and symmetrical; diameter $3\frac{1}{4}$ inches longitudinally and $3\frac{1}{4}$ inches transversely; skin light yellow, changing to bright red at full maturity; flesh yellow and seedless; quality very fine; perhaps the most highly esteemed of light-fleshed kinds.

Triumph (Fig. 2876).—Medium; tomato-shaped; skin yellow; flesh yellow; generally has a few seeds; very productive; quality of the best. Ripens from September till November.

Tsuru (Fig. 2876).—Large, slender, pointed, longest in proportion to its size of all; diameter $3\frac{1}{4}$ inches longitudinally and $2\frac{1}{4}$ inches transversely; skin bright red; flesh orange-yellow, some dark flesh around the few seeds; astringent until fully ripe, then good.

Yeddo-Ichi.—Large, oblate; diameter $2\frac{1}{4}$ inches longitudinally and 3 inches transversely; very smooth and regular in outline, with dented appearing surface and slight depression at end opposite the stem; skin darker red than most varieties, with heavy bloom; flesh very dark brown, verging toward purplish; sweet, rich, crisp; in quality one of the best. The fruit is good to eat when still hard.

Yemon (Among).—Large, flat, tomato-shaped, somewhat four-sided; diameter $2\frac{1}{4}$ inches longitudinally and $3\frac{1}{4}$ inches transversely; skin light yellow, changing to dull red, mottled with orange-yellow; distinct in color; flesh deep, dull red, brown around the seeds, of which there are usually a few; some specimens are entirely light-fleshed and seedless; there is no astringency after the fruit begins to soften; quality fine; one of the best. In form some of the fruits have the corrugations converging to the depressed apex, as it is usually figured, but most do not.

Zengi.—The smallest of all; round or roundish oblate; diameter $1\frac{1}{4}$ inches longitudinally and $2\frac{1}{4}$ inches transversely; skin yellowish red; flesh very dark, quality good; seedy; edible when still hard; one of the earliest to ripen. Vigorous, prolific.

L. H. B.†

PÉRTYA (after A. M. Perty, professor of natural history at Berne, Switzerland). *Compósitæ*. A genus of about 4 shrubs from Japan, Cent. China and Afghanistan, allied to *Mutisia* but the corolla tubular and 5-parted: lvs. alternate, often crowded under the fl. heads, entire or serrulate, deciduous: heads homogamous, solitary, with 5-15 fls.; involucre campanulate, with few large, imbricate bracts; corolla tubular, deeply 5-lobed: achene pubescent, with a conspicuous dense whitish or purplish pappus. They are not particularly ornamental, but interesting for botanical collections, as hardy shrubby *Compositæ* are few. Prop. by seeds and probably by cuttings of half-ripened wood. The only species in cult. is *P. sinénsis*, Oliver. Slender upright shrub, to 6 ft.: lvs. ovate- to oblong-lanceolate, acutish, entire, glabrous, 2-3 in. long: heads pinkish, 10-12-flid., on slender pedicels $\frac{1}{2}$ -1 in. long; involucre nearly glabrous: achenes sericeous; pappus whitish. June. Cent. China. H.I. 23:2214.—The Japanese *P. scândens*, Schultz. Bip., which is likely to be intro., is a slender decumbent shrub with serrulate lvs., sessile somewhat larger heads with light purple pappus.

ALFRED REHDER.

PESCATO-BÓLLEA (compounded from *Pescatoria* and *Bollea*). *Orchidææ*. A genus established to contain hybrids between the genera *Pescatoria* and *Bollea*. *P.-B. bella* = *P. Klabochorum* × *B. cælestis*.

PESCATORIA (after M. Pescatore, who had a large collection of orchids at St. Cloud, near Paris). Sometimes spelled *Pescalorea*. *Orchidææ*. A group of orchids often united with *Zygopetalum*, but in horticultural works usually treated as a distinct genus.

Leaves equitant, tufted, without pseudobulbs: fls. solitary on sts. 3-6 in. long, from the axils of the lvs., mostly large and showy and fragrant; sepals and petals broad, concave, spreading, the lateral sepals forming a mentum; labellum clawed, lateral lobes small, middle lobe rounded, spreading; crest thick, consisting of a number of keels arranged in a semi-circle near the base of the lip; column slender, not boat-shaped.—About 12 species. For cult., see *Zygopetalum*.

Klabochòrum, Reichb. f. Lvs. strap-shaped, 1 ft. or more long: fls. 3-3½ in. across, variable in color; sepals oblong, obtuse; petals shorter, all white with chocolate-purple points; labellum 3-lobed, yellowish or white, and having many purple-tipped hairs; callus sulfur-colored, with brown keels. June, July. Ecuador. Gn. 22:24.

Dayana, Reichb. f. Lvs. tufted, 6-10 in. long: fls. on short scapes; sepals oblong-obovate, acute, white, with green tips; petals rhomboid-rotund; labellum clawed, angled on each side of the base; limb oblong, emarginate, revolute on the sides, white with a callous ring which is purple-violet, the base being of the same color; column yellow, with a red band near the base and the anther of the same color. Late autumn. Colombia. Var. **rhodàkra**, Reichb. f. Sepals and petals with rose tips; labellum orbicular, suffused crimson. B.M. 6214.

cérina, Reichb. f. Fig. 2877. Lvs. in tufts of 4 or 5, cuneate-oblong, pointed, 1 ft. long: peduncles 2-6 in. long, 1-fld.; sepals and petals nearly equal, the latter somewhat clawed, fleshy, rounded, concave, pale straw-color; labellum ovate, yellow, with a thick semi-circular crest. Chiriqui. B. M. 5598 (as *Hunleya cerina*). F.S. 17: 1815 (as *Zygopetalum cerinum*).—Flowers at various seasons, the fls. lasting a long time.

P. cochleàris, Rolfe. Lvs. ob-lanceolate-oblong, acute, 5-9 in. long: sepals and petals nearly equal, lower halves ivory-white, upper reddish maroon; lip 3-lobed, white; column maroon. Andes.

HEINRICH HASSELBRING.

PETALOSTEMUM (Greek for *petal* and *stamen*, alluding to the way in which these organs are joined). Sometimes spelled *Petalostemon*. By some authors, the species have been referred to *Kuhntstera*. *Leguminosæ*. American herbs, mostly western, with long or deep perennial roots, sometimes planted for ornament.

Leaves glandular, alternate; blades unequally pinnately compound; lfts. often broadest above the middle and involute: fls. perfect, in short or elongated spikes; calyx-teeth nearly equal, rather broad, shorter than the tube; corolla white, pink, purple, or violet; petals on long slender claws; standard oblong or obcordate; wings and keel-petal similar, their claws adnate to the sheath of the stamen-tube almost to its summit; stamens 5, monadelphous, alternate with the petals; ovary sessile, 2-ovuled; style subulate: pod included in the calyx, mostly dehiscent, 1-2-seeded. Distinguished from its close relative *Dalea* by having only 5 stamens instead of 9-10 as in that genus.—About 27 species. These low bushy plants with fine-cut lvs. and bearing a constant succession of showy spikes of fls. are very attractive, and well adapted for borders and rock-gardens.

A. Fls. white.

cándidum, Michx. (*Dalea cándida*, Willd.). WHITE PRAIRIE CLOVER. Plants glabrous: sts. erect or rarely prostrate, simple or sparingly branched, 1-2 ft. tall:

lfts. 5-9, the blades linear, oblong or oblanceolate, ¾-1½ in. long, acute, or mucronulate, glandular beneath, more or less cuneate at base, very short-stalked: peduncles terminal, elongated, bracted; spikes cylindric, 1-4 in. long, about ½ in. thick; bracts aculeate, longer than the calyx; corolla white, 2-3 lines long; wings and keel oval; standard cordate; calyx-teeth and pod slightly pubescent. Tenn. to Minn., La., and Texas. B.B. 2 (ed. 2):369.

AA. Fls. rosy purple or violet.

B. Pubescence of the calyx of short close-set appressed hairs.

decumbens, Nutt. Plants sparingly pubescent above or glabrate: sts. solitary or caespitose, ascending or



2877. *Pescatoria cerina*.

decumbent, 1-2 ft. tall, mostly simple: lfts. 5-7, linear or linear-oblong, ¾-¾ in. long, acute or mucronulate, glandular, often involute: spikes ovoid or oblong, ¾-¾ in. long; bracts ovate-lanceolate, with subulate tips; calyx strigillose; shorter than the bracts, tube campanulate, lobes lanceolate or ovate-lanceolate, shorter than tube, acute; corolla pink or rose-purple; standard with an oblong-ovate cordate blade, other petals with oblong blades. N. E. Texas.

BB. Pubescence of the calyx villous or silky-villous.

C. Bracts glabrous or merely puberulent tips.

purpureum, Rydb. (*Dalea purpurea*, Vent. *P. violà-ceum*, Michx.). VIOLET PRAIRIE CLOVER. Glabrous or slightly pubescent, erect, 1½-3 ft. high, branching above: lvs. short-petioled; lfts. 3-5, narrowly linear, ¼-¾ in. long, ½-1 line wide, acute or mucronate at the apex, narrowed at the base, short-stalked: spikes peduncled, oblong to cylindric, ½-2 in. long, about ½ in. thick; bracts above mucronate, nearly glabrous, nearly equaling the pubescent calyx; corolla violet to purple, about 2 lines long; standard cordate, wings and keel oblong. Ind. to Sask. and Texas. B.M. 1707. B.B. 2 (ed. 2):370.

CC. Bracts with silky-pubescent tips.

tenuifolium, Gray. SILKY PRAIRIE CLOVER. Erect, somewhat pubescent, branching, 1-2 ft. high: lvs. short-petioled; lfts. 3-5, linear, obtuse, glandular-dotted, margin somewhat involute, ¼-½ in. long, nearly sessile: spikes cylindric, ½-1½ in. long, about ½ in. thick; rachis pubescent; fls. rose-purple, about ¼ in. long; bracts ovate-pointed, pubescent, equaling the calyx; standard somewhat orbicular to cordate. Kans. to New Mex. B.B. 2 (ed. 2):370.

P. L. RICKER.

PETASITES (Greek, *a broad-brimmed hat*; referring to the large broad leaves). *Compositæ*. Hardy perennial herbs much like the common coltsfoot (*Tussilago Farfara*), having large leaves of the same general shape, but the flowers range from purple to white, not yellow, and are borne in corymbs instead of singly. They are rather coarse and weedy, but the big felty lvs., appearing after the very early leafless scapes, make a good cover for rough or unoccupied places.

The genus is widely distributed in north temperate and subarctic regions. The number of species is about 20; the essential character of the genus (as distinguished from *Tussilago*) is that the heads are nearly or quite dioecious, and rayless or with very short and mostly not showy rays; also the fact that the scapes usually have many heads instead of one. The lvs. are orbicular or reniform, always with a deep heart-shaped base and the scapes are covered with scales like a coltsfoot, but sometimes the lower ones are more leafy.

japonicus, F. Schmidt. Lvs. large, $3\frac{1}{2}$ –4 ft. across, radical: peduncle with 2 or 3 linear bracts: fl.-heads in a fastigate thyrse. Isl. of Sachalin. B.M. 8032. Var. *giganteus*, Hort. Lvs. orbicular, margin wavy: fl.-heads densely clustered. Gn.M. 10:180.—The stalks are eaten as a vegetable after being boiled, and are also preserved in salt or sugar. The fl.-buds, which appear in Feb., are used as a condiment, as they have a slightly bitter but agreeable flavor. The plant has been advertised in Amer. since 1900 by several dealers. Grows as high as a man, and is useful for bold effects in the sub-tropical garden.

fragrans, Presl. WINTER HELIOTROPE. SWEET COLTS-FOOT. Height 8 in.: lvs. appearing during or after anthesis, orbicular, margined with small cartilaginous teeth, glabrous above, pubescent and green below: heads fragrant, the marginal fls. of the female heads in the form of short rays; fls. small, varying from pale lilac to purple. Medit. region. Gn. 23, p. 113; 53, p. 323; 62, p. 58.—Has the merit of blooming in winter and its fls. have a delightful vanilla-like odor. A few sprays are desirable for cutting during winter. The plant also differs from the common coltsfoot in having darker colored and evergreen foliage. It is suitable for carpeting shrubberies and for dry banks of stiff clay where choicer subjects will not thrive. Like most others of the genus, it spreads rapidly by underground runners.

palmatus, Gray (*Nardosmia palmata*, Hook.). Height 6–24 in.: lvs. orbicular or somewhat kidney-shaped, deeply 7–11-cleft beyond the middle, and the lobes sharply dentate, green and glabrous above, densely white-tomentose beneath: heads fragrant, 4–6 lines across, the marginal fls. of the female heads in the form of short rays, whitish. E. Asia, N. Amer. B.B. 3:469.—Blooms from April to June, its fls. varying from nearly white to pale blue or purplish. It is found in rich dark swamps or sphagnum bogs from Newfoundland to Alaska and south to N. Y., Wis., and Calif. It has been offered by dealers in native plants.

officinalis, Moench (*P. vulgaris*, Desf.). Height 16 in.: lvs. 3 in. to 3 ft. diam., reniform or orbicularly cordate, white-hairy below: fls. purplish, appearing before the lvs. in March–May, borne in cylindric panicles. Eu., N. Asia.

WILHELM MILLER.
L. H. B.†

PETIVERIA (named after James Petiver, 1665–1718, an apothecary and botanist of London). *Phytolaccææ*. Shrubby herbs: lvs. alternate: fls. small, in axillary and terminal racemes, solitary or in 2's; perianth herbaceous, conical at base, 4-parted, segms. subequal, lanceolate, spreading; stamens inserted at the base of the perianth on a hypogynous disk, either 4 alternate with the segms. of the perianth or 5–8 placed without order; ovary 2-celled.—About 2 species, S.

PETREA

Fla. to Paraguay. The genus has been recently monographed by Hans Walter in Engler's *Pflanzenreich*, hft. 39 (IV. 83). *P. alliacea*, Linn. (*P. octandra*, Linn. *P. alliacea* var. *octandra*, Moq.). GUINEA-HEN WEED. Half-shrubby, perennial: sts. 2–3 ft. high: lvs. alternate, ovate, entire, membranaceous, attenuate at both ends, pellucid-dotted: infl. erect in a lax raceme; fls. rose or white. Mex. to Brazil. An ornamental stove plant probably not now in cult.

PETRÆA (Robert James, Lord Petré, 1710–1742, a patron of botany who had the finest collection of exotic plants in Europe). Sometimes spelled *Petræa*. *Verbenacææ*. Tropical American woody plants, one of which is a choice blue- or purple-flowered climber.

Twining or arborescent shrubs: lvs. opposite, leathery, pinnate-veined: fls. violet, purple or bluish, in



long terminal racemes; calyx with 5 scales in the throat; calyx-lobes colored during anthesis but often becoming green and rigid in fr.; corolla usually a little more intensely colored; limb 5-cut, oblique, the tube short and cylindrical; stamens 4, didynamous; ovary imperfectly 2-loculed; locules 1-ovuled: fr. included in calyx, indehiscent, 2-celled and 2-seeded or 1-seeded by abortion.—Species about a dozen, Mex., W. Indies to Brazil.

Petrea is well adapted to be grown with other stove climbers. The plants do well when trained to a balloon-shaped or flat wire frame, to pillars, or carried near the roof, where they add greatly to the beauty of the house. When it is intended to plant them out in the border, the first point to be considered is the drainage in the pot. This is best effected by placing a layer of brick rubbish of about 4 to 5 inches. This will keep the compost from becoming sour or stagnant in the pot. For a compost, use turfy loam four parts, turfy peat one part, well-decayed cow-manure one part, with admixture of a liberal quantity of sharp gritty sand. By the end of January the temperature may be increased to about 62° for night with 10° to 15° higher by day. Just as soon as they show renewed vigor they will not stand to become dry at the roots. They will want a good syringing over and under the foliage every morning on bright days. Give enough ventilation to keep the air pure and sweet. In midsummer they need some shade if only during the most powerful sunshine. When they are well established, they will be benefited by liquid manure once a week. For midsummer the temperature may be allowed to run up 80° or 85° with sun, and a night temperature of 70°. They are easily propagated from shoot-cuttings placed in a brisk bottom heat and

subjected to the usual condition of moisture and shade required for other plants. When they are wanted to grow in pots, keep shifting until they are in 8- or 10-inch pots. The compost may be renewed in the spring. (J. J. M. Farrell.)

volubilis, Jacq. **PURPLE WREATH**. Fig. 2878. Twining: lvs. 3-4 in. long, short-stalked, ovate, elliptic or oblong, acuminate or obtuse, entire or wavy: fls. blue, in terminal elongated racemes (7-8 in. long); calyx with a tube one-fourth to one-half as long as the pedicel, and in fr. one-third to one-fourth as long as the narrow lobes; corolla included in the calyx. Cuba to Brazil; a showy plant. B.M. 628. G.C. III. 39:24, 25; 45:252; 51:287. J.H. III. 54:390. G. 29:192. H.F. 8:50. F.E. 23:582. F.C. 3:108. Gn. 12:40.—The purple wreath is one of the most distinct and beautiful of tender climbers. The fls. are like a 5-pointed star of lilac with a violet in the middle. The fls. begin to open at the base of the raceme and the showy 5-pointed star is the calyx, whose sepals are colored like petals. The calyx spreads open while the corolla is still a round bud in the middle, and it remains after the corolla has fallen, so that the vine, at first glance, seems to bear two kinds of fls. The blooms appear in March and April. It does not bloom freely in small plants; it probably has other drawbacks, for it has always been a rare plant in Eu., though enthusiastically commended. Offered in S. Calif. The fls. seem to vary considerably in color.

WILHELM MILLER.
L. H. B.†

PETROCÁLLIS (Greek, *rock beauty*). *Cruciferae*. This genus has been commonly included in *Draba* but differs from it in technical botanical characters as follows: siliques oval with swollen reticulate valves having 1-2 seeds in a cell with the funiculus adnate to the septum. One species in the Pyrenees, *P. pyrenæica*, R. Br. Height 2-3 in.: lvs. wedge-shaped, 3-lobed at apex: fls. white at first, changing to rosy pink. May. Mountains, S. Eu. B.M. 713.—Also found under *Draba pyrenæica*, page 1068; grown as a little rock-plant in choice collections.

PETROCÓPTIS (Greek, equivalent to the Latin *Saxifraga*,—to break or cleft the rock: rooting in the clefts of rocks). *Caryophyllaceae*. Two or 3 perennials from the Pyrenees, sometimes used in alpine- and rock-gardening. Allied to *Lychnis* and sometimes united with it, differing in imbricated rather than convolute aestivation and in bearded or woolly seeds. Perennials of small size with uncut petals and a corolla-crown, the lvs. mostly tufted or in a rosette: st.-lvs. opposite. *P. pyrenæica*, A. Br. (*Lychnis pyrenæica*, Berger). Three to 4 in. high from a fusiform root: lvs. glaucous-green, spatulate, those on the st. cordate and sessile: fls. pale flesh-color or rose-color, about ½ in. across, in forked clusters, the slender pedicels 1-fl.; petals shallowly notched at top, bearing 2 erect serrate scales. B.M. 3269. Var. *alba*, Hort., is listed as a beautiful and easily grown alpine, late blooming. *P. Lagáscea*, Willk. (*Lychnis Lagáscea*, Hook. f.). Low and tufted, glabrous and glaucous, 2-4 in. high: st. densely distichous, leafy below: lowest lvs. linear and obtuse, middle ones ovate-lanceolate, subacute: fls. pale rose with white center, about ½ in. across, with 2 white acute scales at base, slightly notched at apex. B.M. 5746.—A charming plant.

L. H. B.

PETRÓPHYTES: *Monanthes*. *P. muralis*, Webb—*Monanthes muralis*, Hook. f., which equals *M. atlantica*.

PETRÓPHYTUM (*petros*, rock, and *phyton*, plant; alluding to its habitat). *Rosaceae*. A genus of 5 caespitose undershrubs with prostrate branches in W. N. Amer., allied to *Spiræa*, but differing in its follicles being dehiscent on both sutures and in its habit: lvs. crowded,

spatulate or oblanceolate, entire: fls. in terminal racemes; sepals and petals 5; stamens 20; pistils 3-5, hairy, style slender, glabrous except at the base: follicles leathery, with few linear seeds. Only the following species has been intro. into cult. and is offered by several European nurseries. It is perfectly hardy and grows best in a rockery in a sunny and well-drained position between rocks; it demands limestone soil. Prop. is by division or by seeds treated like those of *spirea*, but the young seedlings are particularly impatient of too much moisture. *P. caespitosa*, Rydb. (*Spiræa caespitosa*, Nutt. *Eriogynia caespitosa*, Wats. *Luétkea caespitosa*, Kuntze). Densely caespitose, forming flat patches: lvs. oblanceolate, obtuse or mucronate, 1-ribbed, densely silky, ¼-½ in. long: fls. small, white, in dense spikes ½-1½ in. long on upright stalks 1-4 in. long; petals spatulate, obtuse; stamens exserted. July, Aug. S. D. and Mont. to Calif. and New Mex. M.D.G. 1907:85.

ALFRED REHDER.

PETROSELINUM (Greek, *rock-parsley*). *Umbelliferae*. About a half-dozen European chiefly biennial herbs, one of which is cult. for its ornamental and edible herbage. Closely allied to *Carum* and *Apium*, with the former of which it is often united and from which it is chiefly distinguished by the greenish yellow fls. and broader incised lf.-segments. Lvs. ternately pinnate-compound, the segms. toothed and cut: fls. in compound umbels with few parts to the involucre and several or many parts to the involucels, the petals with incurved points: fr. ovate and compressed, glabrous. *P. hortense*, Hoffm. (*P. sativum*, Hoffm. *Carum Petroselinum*, Benth. & Hook. f.). **PARSLEY** (which see). Erect, 1-3 ft.: lvs. ternate-pinnate, the lfcs. ovate and 3-cleft (much cut in the "curled" garden varieties), the upper ones narrower and nearly entire: fls. yellowish. Old World.—Much cult., and sometimes runs wild about plantations.

L. H. B.

PETTERIA (after Franz Petter, a Dalmatian botanist; died 1853). *Leguminosae*. One species, a shrub, very similar in habit to *Laburnum*, but with the yellow fls. in upright dense racemes, terminal on leafy branchlets. It is but rarely cult., since it is less showy in bloom than *Laburnum* or many species of *Cytisus*. It is hardy as far north as Mass., and requires the same cult. as *Laburnum*, which see. If grafted, *laburnum* is to be used as a stock. This monotypic genus differs from *Laburnum* in its upright racemes, in the tubular calyx, the wings and keel being at the base adnate to the stamens, and in the sessile ovary. It is said to possess the same poisonous properties as that genus.

ramentacea, Presl (*Cytisus fragrans*, Welden, not Lam. *C. Weldenii*, Vis. *C. ramantaceus*, Sieb. *Laburnum ramentaceum*, Koch. *L. Weldenii*, Lavallée). Upright, to 6 ft.: lvs. 3-foliolate, almost glabrous or sparingly pubescent when young, on about 1-in.-long stalks; lfcs. cuneate, obovate to oblong, usually obtuse, ¾-2 in. long: fls. fragrant, very short-pedicelled, in 1-3-in.-long dense racemes; calyx 3-lobed, silky; keel silky: pod linear-oblong, sparingly silky, to 1½ in. long. May, June. Dalmatia, Istria. B.R. 29:40.

ALFRED REHDER.

PETUNIA (*Petun*, South American aboriginal name, said to have been applied to tobacco). *Solanaceae*. **PETUNIA**. Small herbs, grown for their showy bloom as garden annuals.

Annual or perennial, branching, viscid-pubescent, of weak or straggling growth: lvs. alternate, or opposite above, soft, entire: fls. white or purple, or in shades of reddish, on solitary, terminal or axillary peduncles; calyx deeply 5-parted, the lobes narrow or often foliaceous; corolla funnelform or salverform, the tube long and nearly or quite straight and sitting loosely in the calyx, the limb broad and normally 5-lobed, unequal or

oblique and in some species obscurely 2-lipped; stamens 5, attached in the tube, one of them sometimes sterile; ovary small, 2-celled, the style slender, the stigma dilated and sometimes obscurely 2-lobed.—There are 12 or more species of *Petunia*, mostly natives of the southern part of S. Amer. One or two grow in Mex. and



2879. *Petunia axillaris*. ($\times \frac{1}{2}$)

another (*P. parviflora*) is naturalized in the southern parts of the U. S., and is found frequently on ballast about seaports. The genus is closely allied to *Salpiglossis*, being distinguished by 5 perfect stamens, whereas that genus has 4 stamens and lvs. narrow or usually dentate or pinnatifid.

Garden petunias are small soft plants of straggling or decumbent habit, pubescent and usually more or less sticky, with large showy flowers. The colors are white to light purple, not blue, clear red, nor yellow. They are properly perennial, but are treated as annuals in cultivation. The common kinds are rather weedy in habit, but their great profusion of bloom under all conditions makes them useful and popular. They are particularly useful for massing against shrubbery, for they make a florid undergrowth with almost no care. Some of the modern improved named varieties are very choice plants. Petunias emit a powerful fragrance at nightfall, and sphinx-moths visit them.

The varieties of present-day gardens are considered to be hybrids and modifications of two-stem types. The types were white-flowered in one case and rose-violet in the other, and the flowers were small. In some of the garden strains, the flower is very broad and open, measuring 4 or 5 inches across. There are types with the flowers deeply fringed; others with star-like markings radiating from the throat and extending nearly or quite to the margin of the limb; others with full double flowers.

Petunias should begin to bloom about two or two and one-half months after sowing in the open and continue profusely till killed by hard frost (the first light frosts usually do not injure them). The plants are at first erect, but soon begin to sprawl. The highest blooms of mature but sprawled plants will stand 18 to 24 inches above the ground. There are very dwarf and compact kinds, but they are not much seen in this country.

Varieties or strains naturally fall into the small-flowered and large-flowered classes. The former are singles and are mostly used for bedding or massing. Some of the small lilac-limbed kinds are apparently very closely related to the stem-species, *P. violacea*, possibly direct derivatives of it. Countess of Ellesmere, Rosy Morn, and similar ones are among the best rosy or pink kinds for edgings and hanging-baskets and window-boxes. Large-flowered petunias are double or single,

fringed, ruffled, fluted, and otherwise modified, some of them having deep velvety colors of great richness and flowers of much substance. There are marbled, spotted, and penciled flowers among them.

Double forms are produced by crossing the most double flowers that are capable of producing good pollen on the best single strains. Only a part of the seedlings produce doubles, but all the others are likely to produce superior semi-double and single forms. Single flowers carefully pollinated from double flowers will produce seed which will average 25 per cent doubles, and single flowers bearing petaloid anthers similarly pollinated will give an average as high as 40 per cent doubles. The weaker seedlings are most likely to give full double flowers.

Petunias thrive on both ordinary and rich soil, blooming well on land too rich for other plants, and some of the bedding and small kinds doing well even on poor soil with plenty of moisture. They are sun-loving plants, although they bloom well in partial shade. The culture is simple and easy. Seeds may be sown directly in the open, or the plants may be started in flats or pots indoors for early results. The plants are tender and therefore should not be trusted in the open until settled weather comes. The high-bred types require more care in the growing. They would best be started indoors, and be given the choicest positions in the open garden. Extra care should be given to the germination, for every seed that is lost may mean the loss of a form unlike any other; for these high-class petunias are not fixed into definite seed-varieties to any extent. Usually the weakest plants in the lot of seedlings will produce the choicest results among the high-bred single and double strains, the strongest seedlings tending to make weedy plants. Transplanting is recommended for the high-bred fringed and double strains, as well as for early bloom. The seeds are small and should be covered lightly in well-pulverized soil. On ordinary soil, petunias may be thinned or transplanted to 10 or 12



2880. *Petunia hybrida*. ($\times \frac{1}{2}$)

inches apart each way; but on fertile soil, and particularly with the larger-growing forms, the distance may be as much as 15 to 18 inches. Young petunia plants are very susceptible to frost. It is well to pull out some of the least desirable plants as they grow and begin to crowd. The stronger common strains of petunia are likely to self-sow or volunteer (come up themselves in the spring from seed). Fancy kinds are sometimes propagated by cuttings or slips from plants carried over winter, after the manner of geraniums. The best double strains particularly are often perpetuated by cuttings. There are no special insects or diseases attacking the petunia.

Winter bloom is easy to secure from petunias under glass. Best, or at least quickest, results are secured from cuttings; these may be taken from good shoots in late September or early October from selected outdoor plants, and bloom should be secured by February 1. If plants are grown from seeds, the sowing should take place in late summer, for seedlings grow slowly in the short days of fall and winter; the seedlings should be handled in pots. Sometimes old plants that are not spent are lifted in the fall and cut back, and the new growth will give good winter bloom. Petunias under glass require cool treatment, a night temperature of 45° to 50° suiting them well. A somewhat warmer treatment than that given carnations may be expected to produce satisfactory results.

axillaris, BSP. (*P. nyclaginiflora*, Juss. *Nicotiana axillaris*, Lam.). Fig. 2879. LARGE WHITE PETUNIA. Tall and relatively stout, usually growing erect: lvs. large and rather thick, oval-oblong, upper ones nearly or quite sessile and the lower ones narrowed into a distinct petiole: fls. dull white, long-tubed (the tube 3 or 4 times the length of the calyx), fragrant at evening. Argentina. B.M. 2552.—Frequently seen in old gardens, and also escaped.

violacea, Lindl. VIOLET-FLOWERED PETUNIA. Stems slender: lvs. oval or ovate, sessile or very short-stalked: fls. smaller, broad-tubed (the tube twice or less the

length of the linear calyx-lobes), rose-red or violet, the limb relatively short. Argentina. B.R. 1626. B.M. 3113 (as *Salpiglossis integrifolia*).—This species, or its garden derivatives, sometimes runs wild from gardens.

hybrida, Hort. Figs. 2880–2882. Common petunia, probably a hybrid derivative of the two preceding. For history, see Bailey, "Survival of the Unlike." P.M. 2: 173 (as *P. nyclaginiflora violacea*).

B.M. 3556.—This type is remarkably variable, but it differs markedly from either parent: from *P. axillaris* in its broader tube and many colors; from *P. violacea* in its longer tube, wider limb, and many colors; from both in its much larger and multiform fls. and more stocky growth. In some of the strains, the fl. is very broad and open, measuring 4 or 5 in. across. There are types



with the fls. deeply fringed; others with star-like markings radiating from the throat and extending nearly or quite to the margin of the limb; others with full double fls. The colors range from white to deep red-purple, and variously striped and barred. There are forms of very dwarf and compact habit.

L. H. B.



PEUCÉDANUM (ancient Greek name). *Umbelliferae*. There are many views as to the limits of the genus *Peucedanum*, which is equivalent to saying that it has no natural limits. Bentham & Hooker made it a most complex group, comprising about one hundred Old World and New World species, and including such genera as *Petroselinum*, *Anethum*, *Imperatoria*, *Polycyrtus*, *Tommasinia*, *Pastinaca*, *Tiedmannia*, *Lomatium*. Coulter & Rose, American monographers ("Monograph of the North American *Umbelliferae*," United States Department of Agriculture, 1900), remove the American species and accept Rafinesque's genus *Lomatium*, where these species may be found (page 1903, Vol. IV). The parsnip has been included in this genus as *P. sativum*, Benth. & Hook., but is here kept distinct under *Pastinaca*. Various species of *Peucedanum* may be transferred to grounds in Europe, or the countries where they grow, but they are not known as horticultural subjects.

PEUMUS (Chilean name). Syn., *Boldo*, *Boldèa*, *Ruizia*. *Monimideae*. The Chilean boldo, a small tree of considerable economic interest.

Evergreen tree or large shrub of 1 species, *P. Bóldus*, Molina (*P. fràgrans*, Pers. *Ruizia fràgrans*, Ruiz & Pav. *Boldo fràgrans*, Gay): dioecious: male fls. with 10–12 perianth-lobes, overlapping in 2–3 series, the outer ones herbaceous or membranous, the inner ones more petal-like; stamens numerous; female fls. smaller, the lobes more unequal, after anthesis circumscissile above the disk-bearing base and deciduous: drupes 2–5 or rarely solitary, stipitate on the receptacle; seeds pendulous: the tree attains a height of 20 ft., with lvs. opposite, leathery, very rough and warty, ovate or ovate-elliptic, short-petioled, obtuse. Chile. B.R. 31:57.—The tree has exceedingly hard wood, which is used for making many kinds of implements; it also makes a charcoal said to be prized by smiths above all others. The bark is used in tanning and dyeing. The lvs. are used in medicine. The frs. are edible; they are small berries, sweet and aromatic. Finally it has some ornamental value, being evergreen and fragrant throughout. The fls., which are not very showy, are white, 1/2 in. across, and borne in small panicles, each branch of which is parted into three. It has been advertised in S. Calif.

The male tree has been cult. under glass in Eu., but scarcely outside of botanic gardens and for its economic interest.

L. H. B.

PFÄFFIA (C. H. Pfaff, 1774-1852, German chemist). *Amarantidaceae*. Slender perennial herbs from Trop. and extra-Trop. S. Amer., tomentose or villous, rarely glabrate: lvs. opposite, sessile or nearly so, entire: heads or spikes densely fld.; bracts and bractlets transparent: fls. usually in solitary long-peduncled heads, bracteate and with 2 bractlets; perianth 5-parted; staminal tube long, 5-cut to the middle, the anther-bearing teeth ciliate at the margin; stigma discoid or head-like, entire or 2-lobed.—Species about 20, one of which is known more or less in gardens, although it is not certain whether the plants that have been in the trade are properly named.

gnaphaloides, Mart. (*Gomphrena gnaphaloides*, Vahl). Perennial, 1 ft.: sts. subshrubby below: lvs. lanceolate, 10-15 lines long, 2-4 lines wide, soft, ashy gray above, woolly beneath: peduncles 5-7 in. long; heads globose, 6-9 lines across; bracts unequal, ovate, mucronate, scarious, the lower one villous, lateral ones longer, glabrous at the base; stigma globose. Brazil, Uruguay.—Recorded as a stove plant in England, but the plant that has been offered in this country was recommended as an outdoor perennial.

WILHELM MILLER.

PFEIFFERA (named for Ludwig Pfeiffer, a distinguished student of cactus). *Cactaceae*. Epiphytic plants, at first erect but branches usually hanging, mostly 4-angled: areoles bearing small acicular spines: fls. regular, rose-colored, small: ovary and fr. spiny; seeds black. This genus was included in *Rhipsalis* in Cyclo. Amer. Hort.

ianthothèle, Web. (*Rhipsalis ianthothèle*, Web. *R. cereiformis*, Foerst. *P. cereiformis*, Salm-Dyck). Sts. pendent, 1-2 ft. long, branching, less than 1 in. diam., 4- rarely 3-angled: ribs tuberculate: areoles at summit of tubercles short-woolly, soon naked, bearing 6-7 short bristles: fls. with very short tube, but the fl. bell-shaped, purple-red without, pure white within, nearly 1 in. long, little more than half as much wide: fr. the size of a cherry, rose-red, with bristles like those of the st. Argentina.

J. N. ROSE.

PHACELIA (Greek, *cluster*; on account of the crowded flower-clusters of the first described species). *Hydrophyllaceae*. Annual and sometimes perennial herbs, grown for the blue, purple, or white flowers.

Low or not tall plants, with alternate simple or compound lvs. and infl. in more or less scorpioid cymes or spikes: corolla deciduous as the caps. enlarges, in various shades of blue, purple, or white; tube with or without interval appendages, these when present in the form of 5 or 10 vertical folds or projections, adnate to or free from the bases of the filaments; calyx-lobes commonly narrow, often enlarged upward, especially in fr.; style more or less 2-lobed: seed-coats reticulated or pitted.—Species 114, as defined by Brand in hft. 59 (IV. 251) of Engler's "Das Pflanzenfamilien" (1913), American, mostly from W. N. Amer. The plants are hairy, nearly smooth, or glandular in whole or in part. The herbage of some of the glandular-hairy species has an offensive odor.

The genus includes the old genera *Whitlavia*, *Eutoca*, *Microgenetes*, *Cosmanthus*, and others. The flowers are mainly of a handsome blue or violet, many species and varieties running through lighter shades to pure white, but not to yellow. The annuals are of easy cultivation, requiring, to bring them to perfection, a soil warm, sunny, and not too moist. Some species like a sandy soil, others a firmer clay. Some are erect and give the best effects when planted thickly; others are more spreading and therefore require considerable space. In

PHACELIA

height they vary from only a few inches to 2 to 3 feet. The flowers are borne on more or less recurved racemes that straighten as the flowering proceeds. They vary from 1 inch long in some species to less than $\frac{1}{4}$ inch in others. In addition to those described below there are many other beautiful species of phacelia that should be in the trade. The species best known in cultivation is *P. Whitlavia*, a garden annual known as *whitlavia*.

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A. Seeds transversely corrugated, not pitted or reticulated as in the other sections.

1. *Orcuttiana*, Gray. Viscid, puberulent, about 1 ft. high: lvs. pinnatifid, somewhat lyrate, the lobes short-oblong and entire: fls. sessile in the at length elongated

dense spikes; corolla rotate-campanulate, double the length of the calyx, with limb 3-4 lines broad, white, with yellow eye, nearly or quite destitute of internal appendages: caps. oval, nearly equaling the narrowly spatulate (barely 2 lines long) sepals, 12-14-seeded; seeds oval, obscurely favose-reticulated between the transverse corrugations. Low. Calif.

AA. Seeds pitted, punctate or reticulated.

B. Corolla without internal appendages.

2. *fimbriata*, Michx. (*Cosmanthus fimbriatus*, Mey.). Weak and diffuse annual, a span high, somewhat hirsute: cauline lvs. 3-7-cleft or -lobed or



2883. *Phacelia viscida*. ($\times \frac{1}{2}$)

the lower lyrate divided, the lobes obtuse or roundish: racemes few-fld.; pedicels filiform; calyx-lobes linear-oblong or spatulate; corolla white, only 3-4 lines broad, shorter than the stamens, its lobes fimbriate. Alleghany Mts., Va. to Ala.; April, May.

3. *viscida*, Torr. (*Eutoca viscida*, Benth.). Fig. 2883. Annual, a foot or 2 high, branching, hirsute at base, very glandular above: lvs. ovate or obscurely cordate, doubly or incisely and irregularly dentate, 1-3 in. long: corolla deep blue, with purple or whitish center, from half to nearly an inch in diam. S. Calif. B.M. 3572. B.R. 1808. R.H. 1851:361. J.H. III. 29:183; 48:302. Var. *albiflora*, Gray. Fls. white.

BB. Corolla bearing internal appendages.

c. Appendages 5, small and truncate or emarginate and attached to the base of each filament.

4. *Whitlavia*, Gray (*Whitlavia grandiflora*, Harv.). *WHITLAVIA*. CALIFORNIA BLUEBELL. Fig. 2884. An attractive and variable easily grown annual, about 1-1 $\frac{1}{2}$ ft. high, loosely branching, hirsute and glandular: lvs. ovate or deltoid, incisely toothed: corolla with cylindrical ventricose tube usually an inch long, thrice

the length of the lobes; appendages to the filaments hairy. S. Calif. B.M. 4813. F.S. 11:1085. G.C. 1854: 679.—A beautiful species and much cult., with fls. an inch long and nearly as wide; sometimes escaped in Eu. Var. *gloxinioides*, Voss (*Whillavia gloxinioides*, Hort.), has handsome white fls. with blue center. Var. *alba*, Hort. (*Whillavia alba*, Hort.), is white-flid.

5. *Párryi*, Torr. Annual, rather slender, 9–18 in. high: lvs. ovate, irregularly and incisely double-toothed or lacinate, or the lowest sometimes pinnately parted; the upper cauline longer than their petioles: corolla cleft beyond the middle, deep violet, 8 lines across; filaments bearded: ovules on each placenta 20–30; seeds 15–20. Calif. B.M. 6842. G.C. II. 24:716. Gt. 34:1207.

6. *campanulària*, Gray. Annual, lower than the last: lvs. subcordate or cordate, less deeply dentate: tube of the truly campanulate corolla $\frac{1}{2}$ in. long, expanded at throat, barely twice the length of the lobes; appendages to the filaments glabrous and smaller, otherwise much like No. 4 and almost as showy. S. Calif. B.M. 6735. G.C. II. 20:135; III. 55:173. F. 1883:145. Gn. 31, p. 554; 55:36.—*P. campanulàta*, Hort., is presumably this plant.

cc. Appendages in corolla 10.

d. Ovules numerous, or more than 2, on each placenta.

7. *lineàris*, Holz. (*Hydrophyllum lineàre*, Pursh. *Eutoca Mènzesii*, R. Br. *P. Mènzesii*, Torr. *Eutoca multiflora*, Douglas). Annual and perhaps perennial, 9–12 in. high, at length paniculate-branched, hispid or roughish hirsute, usually also minutely cinereous-pubescent: lvs. mostly sessile, linear or lanceolate, entire or a few of them deeply cleft, with few or single linear or lanceolate entire lobes: spikes or spike-like racemes thyrsoid-paniculate, at length elongated and erect; corolla bright violet or sometimes white; ovules 12–16: caps. shorter than the calyx; seeds oblong, coarsely favose-reticulated. Calif. to Wash., and east to Mont. and Utah. B.R. 1180. B.M. 3762.—A beautiful species, and easily cult.

8. *divaricàta*, Gray (*Eutoca divaricàta*, Benth. *E. mexicana*, Hort.). Diffusely spreading annual, a span high, more or less hirsute and pubescent: lvs. ovate or oblong, mostly longer than the petiole, sometimes 1–2-toothed or lobed at base, the rims curving upward: spikes or racemes at length loose; the pedicels usually

much shorter than the calyx; style 2-cleft at apex: ovules 12–20 on each placenta. Calif. B.M. 3706. B.R. 1784. Var. *Wrangeliana*, A. DC. Fig. 2885. Differs from the type in having the lvs. inclined to be lobed or 1–2-toothed. It is known to the trade as *Eutoca Wrangeliana*, Fisch. & Mey. P.M. 5:199.



2885. *Phacelia divaricata* var. *Wrangeliana*. ($\times \frac{1}{2}$)

dd. Ovules only 2 on each placenta.

e. Lvs. all simple and entire (except perhaps the lowest).

9. *hàmilis*, Torr. & Gray. Annual, unbranched or branched from the base, 2–6 in. high, pubescent or infl. often hirsute: lvs. spatulate, oblong or oblanceolate, generally obtuse, the lower rarely with 1–2 ascending lobes: spikes loosely paniculate or solitary; corolla indigo-blue, rather deeply lobed, surpassing the usually linear calyx-lobes; filaments moderately exserted, glabrous or sparingly bearded above. Calif. to Wash.—A pretty little plant.

ee. Lvs. oblong or narrower, pinnately toothed to compound.

10. *bipinnatífida*, Michx. Biennial, erect, branched, 1–2 ft., viscid above: lvs. with slender petioles, to 5 in. long, pinnatifid, with 3–7 ovate or oblong dentate or pinnatifid segms.: fls. violet or blue, $\frac{1}{2}$ in. or more broad, in loose racemes which are little scirpioid; calyx-lobes linear; corolla rotate-campanulate with conspicuous ciliate appendages in pairs between the stamens. N. C. to Mo. and south.

11. *glandulòsa*, Nutt. (*Eutoca glandulòsa*, Hook.). Viscid-pubescent and glandular annual, softly if at all hirsute, 9–12 in. or more high: lvs. irregularly and interruptedly 2-pinnatifid, or below divided; the numerous lobes oblong, small, somewhat incised, obtuse: calyx-lobes oblong or spatulate; corolla about 2 lines long, bluish, purplish or white, with lobes shorter than the tube; stamens and 2-cleft style moderately or conspicuously exserted: seeds with the minute reticulations even. Texas to Ariz. and north to Mont.



2884. *Phacelia Whillavia*. ($\times \frac{1}{2}$)

12. *congesta*, Hook. (*P. conferta*, Don). Pubescent and commonly cinereous erect annual, hardly viscid or glandular in the least, a foot or more high: lvs. pinnately 3-7-divided or -parted, and with a few interposed small lobes, the main divisions oblong or oval, incisely pinnatifid or irregularly lobed, the lower ones mostly petiolate and the upper confluent: calyx-lobes linear or somewhat spatulate; corolla blue, 3 lines long, the lobes as long as the tube; stamens more or less exserted: seeds reticulate scabrous, the fine sharp meshes being, as it were, toothed at the junctions. Texas, New Mex. B.M. 3452. V. 5:154; 12:140.

13. *tanacetifolia*, Benth. (*P. tripinnata*, Hort.). Erect annual, often cult., roughish hirsute or hispid, not glandular, or above slightly so, 1-3 ft. high: lvs. pinnately 9-17-divided into linear or oblong-linear once or twice pinnately parted or cleft divisions, all sessile or nearly so, the lobes mostly linear-oblong: spikes cymosely clustered, at length elongated: very short fruiting pedicels ascending or erect: calyx-lobes linear or linear-spatulate, not twice the length of the ellipsoidal caps.; stamens and style conspicuously exserted: seeds with very narrow pits bounded by thick walls. Calif. B.M. 3703. B.R. 1696.—Said to be sometimes cult. as a bee-plant. According to Jepson, "Cows fed on it show a marked increase in yield of milk but will not eat it alone at first." Variable. Var. *alba*, Hort., has been offered.

L. F. HENDERSON.
L. H. B.†

PHÆDRANÁSSA (Greek, *gay queen*, suggested by the beauty of the flowers). *Amaryllidaceæ*. Tender mostly summer-blooming bulbs, with flowers that are tubular in appearance, borne in umbels, generally drooping and usually bright red with green tips.

Bulb tunicated: fls. on a peduncle or scape 10 in. to 2 or 3 ft. long; perianth subcylindrical; segms. 6, equal, regular, spreading only at the tip; stamens inserted at or below the throat of the tube; ovary 3-celled; ovules many, superposed: caps. globose, loculicidally 3-valved; seeds many, small, black: lvs. petioled, oblong or lanceolate, produced after the fls. according to Baker, but this point is doubtful for all species.—Species 4 or 5, in the Andes at 7,000-12,000 ft., except *P. Carmiolii*, a native of Costa Rica, which differs from all other species in having the perianth-segms. much shorter than the tube. Probably the choicest species is *P. chloracra*, the tube of which seems at first sight over 2 in. long; however, the segms. are merely connivent and it is only for a distance of $\frac{1}{4}$ in. at the base that they are really grown together into a tube. This species has 6-12 fls. in an umbel. *P. gloriosa*, Hort., recommended by some dealers, seems to be unknown to botanists. The species are kept rather dry in winter, and bloomed in the open or perhaps under glass in spring, summer, or autumn; prop. by offsets. They apparently thrive under the treatment afforded by a cool greenhouse.

A. Tube of perianth much shorter than the segms.

B. Fls. chiefly red.

chloracra, Herb. (*P. obtusa*, Herb. *Crinum quitense*, Spreng.). Bulb globose, 2-3 in. thick: lvs. produced after the fls.; blade 8-12 in. long, 2-3 in. wide, oblong-lanceolate and acute, the petiole clasping: peduncle 2-3 ft. long, nearly terete, glaucous; fls. scarlet, tipped green, 6-12 in the umbel, usually drooping, $1\frac{1}{2}$ -2 in. long. Andes of Ecuador, to 12,000 ft. B.M. 5361. B.R. 31:17.—The name is sometimes erroneously written *P. chloracea*.

BB. Fls. chiefly green.

viridiflora, Baker. Bulb ovoid, $1\frac{1}{2}$ in. thick: lf. solitary, bright green, lanceolate, nearly 1 ft. long; petiole short: peduncle 1 ft. long, terete; fls. about 4 in an umbel, green toward the tip, without any red, passing into whitish toward the base, drooping, the

perianth-limb $1\frac{1}{4}$ - $1\frac{1}{2}$ in. long. Andes of Ecuador.—Possibly a color variety of *P. chloracra*.

AA. Tube of perianth much longer than segms.

Carmioli, Baker. Bulb globose, 2-3 in. diam.: lvs. 1-2, equaling peduncle, oblong-lanceolate, acute, bright green, the petiole much shorter than blade: peduncle about 2 ft. long, terete, pale glaucous-green, bearing 8-10 fls. in an umbel; fls. with perianth-limb 2 in. long, the bright red tube cylindrical and 3 times as long as the oblong-lanceolate green pale-edged segms.; stamens exserted. Costa Rica. B.M. 8356, where it is said the plant requires complete rest after the lvs. die down. "The tall fl.-stalk precedes the lvs., which, however, develop while the plant is in flower."

WILHELM MILLER.
L. H. B.†

PHÆDRÁNTHUS (Greek for, *splendent* or *gay*, and *flower*, alluding to the brilliantly colored flowers). *Bignoniaceæ*. Ornamental vine grown for its very showy flowers and also for its handsome foliage.

Evergreen climbing shrub: lvs. opposite, with 1 pair of entire lfts., the terminal lft. usually replaced by a 3-parted or repeatedly 3-parted tendril: fls. in terminal racemes; calyx campanulate, 5-10-nerved, leathery, tomentose, with 5 unequal short teeth; corolla tubular-funnelform, curved; stamens slightly exserted; disk annular, raised; ovary ovoid, tomentose, with many ovules in several rows.—One species in Mex. Formerly usually referred to *Bignonia*, from which it differs chiefly in the slender filiform tendrils, the leathery tomentose calyx, the exserted stamens and tomentose ovary.—A very handsome strong-growing vine for subtropical regions or in the N. for the cool greenhouse; one of the most showy bignoniads on account of its large brilliantly colored fls. For cult. and prop., see *Bignonia*.

buccinatórius, Miers (*Bignonia Cherère*, Lindl. *B. Kerère*, Hort., not Aubl. *B. buccinatória*, Mairet). Tall tendril-climber; branches obtusely angled: lfts. 2, or sometimes 3, elliptic to ovate-oblong, cuspidate or obtuse, thinly coriaceous, glabrous and lustrous above, tomentose beneath while young, later hairy only on the veins, glandular, 2-3 in. long: fls. pendulous, in terminal racemes with erect stout and short rachis; calyx $\frac{1}{2}$ in. long; corolla 4 in. long, blood-red, yellow at the base, lobes spreading, emarginate, about $\frac{1}{2}$ in. long. Summer. Mex. B.M. 7516. Gn. 26:520. B.R. 1301. R.H. 1898:580.

ALFRED REHDER.

PHÆNÓCOMA (*shining hair*, Greek, alluding to the involucre). *Compositæ*. A South African little shrub, sometimes grown under glass for the showy flower-heads.

Of the *Gnaphalium-Helipterum-Helichrysum* relation, one species: heads heterogamous, very many-flid., showy because of the brilliant and elongated inner scales of the involucre; florets all tubular and 5-toothed, the marginal female and in a single row, the others male with abortive stigma; receptacle naked; pappus of many rough bristles in a single row, equaling the corolla, somewhat unlike as between the female and male fls. The stiff parts of the involucre make it useful as an everlasting, for which use it is a very showy subject.

These are handsome and distinct evergreen plants. They need a cool airy and shaded house during the summer. They should have plenty of ventilation in the spring and well into the autumn; this will tend greatly to solidify the growth, this causing the greater production of flowers. It is better to place the pots on screened coal-ashes, as this helps to keep the roots cool and moist. They are better if kept by themselves, as they should not be syringed. Watering is a matter of great importance at all seasons. They need some staking and tying so as to keep them in shape. When the weather is cool enough, they should have a temperature

of 45° to 50° at night, with about 10° rise with sunshine. In midwinter the temperature may drop to 40° at night. Any repotting may be done after they are through flowering. Compost used for potting these plants should be loam and fibrous peat in equal parts, left lumpy, and about one-third of silver sand added to the mixture. Give the pots thorough drainage.—They may be increased from cuttings made of the points of some of the moderately strong growths, leaving them about 3 inches long. Place in pans filled with sand. Give them a temperature of about 55°, keeping them moderately close, shaded, and moist. When they show signs of root-formation they may be given more light. When rooted, pot off into small pots using the compost mentioned above, and by shifting and the same culture they grow into good plants in two years. When they get into 8- or 10-inch pots, with plenty of roots, they may have liquid feeding which will help to retain their vigor. These plants are not much seen in this country, but should be more grown. (J. J. M. Farrell.)

prolifera, Don (*Xeranthemum proliferum*, Linn. *Helichrysum proliferum*, Willd.). An old cult. plant, now little grown: sts. woody, 1-2 ft. high, much branched, short side-branchlets tomentose and with minute closely imbricated scale-like lvs., on the main sts. the lvs. acuminate, rigid, and deciduous: heads terminal, solitary, 1-1½ in. across; involucre with many rows of woolly-based scales, the inner ones being rosy purple as if rays and lanceolate-acuminate. Mountains in the Cape region. B.M. 2365. B.R. 21. Var. *Barnesii*, Hort., has heads of deep crimson.

L. H. B.

PHÆOMERIA (Greek, *dark* and *part*). *Zingiberaceæ*. Perennial herbs from a thick rhizome, grown in the hothouse for their foliage and fls. Flowering sts. separate from the leafy ones; the latter not rarely tall, sometimes gigantic and forming very dense reed-like thickets; the former everywhere smaller although sometimes about 3 ft.: lvs. distichous, often numerous, rather large, provided with a commonly leathery ligule: fls. sessile, in spikes or heads, often large or very large, either broad-pyramidal or subglobose, rarely concave at the top, surrounded commonly by a rather large involucre composed of colored bracts, the flowering bracts smaller and less intensely colored; calyx tubular or subclavate, frequently deeply split on one side, often very short-acuminate or not at all lobulate at the top; corolla-tube narrowly cylindrical, dilated toward the top; the lobes narrow, subspatulate, subequal: caps. or rather berries massed together somewhat resembling a pineapple.—About 16 species. Ceylon, to New Guinea. *Phæomeria* was formerly included in *Amomum* but is now considered a distinct genus: *P. magnifica*, Schumann (*Alpinia magnifica*, Roscoe. *Amomum magnificum*, Benth. & Hook. f.), is described under *Amomum*. See Vol. I, p. 275.

F. TRACY HUBBARD.

PHÆONEÛRON (Greek, *dark nerve*). *Melastomaceæ*. Half shrubby or perennial herbs: lvs. opposite, the opposed pair often differing in size: fls. 5-ranked, medium-sized; calyx obovate, margin entire and not crenate; corolla broad-oval, rather acute; stamens 10, equal or subequal; anther rather thick, linear, connective drawn out behind in a thick almost quadrangular appendage and provided in front with 2 fleshy ball-like thickenings; pistil twice as long as the stamens; ovary 5-celled, the lower half joined to the calyx-tube by the septæ: fr. a fragile apparently unevenly bursting caps.; seeds numerous.—About 4 species, Trop. Afr. *P. Moldeneyi*, Stapf. St. herbaceous, terete: branches obtusely tetragonous: petioles and panicles covered with purple furfuraceous pubescence: lvs. 4-6 in. long, ovate or elliptic-ovate, subacuminate, base rounded or subcordate, 5-7-nerved: infl. terminal, lax-flid.; fls. short-pedicelled; calyx hemispheric, mouth truncate, entire;

petals obliquely obovate, pale rose-purple within: fr. a globose berry; seeds rhombic-cuneiform, numerous. W. Afr. B.M. 7729.—A tropical house plant cult. sparingly in botanic gardens.

F. TRACY HUBBARD.

PHAIOCALANTHE (compounded from *Phaius* and *Calanthe*). *Orchidaceæ*. A group of orchids established to contain the hybrids between *Phaius* and *Calanthe*. *Pc. Colmanii* (C. Regnier Stevensii × P. Norman).—*Pc. Codksonii*. J.H. III. 68:443.—*Pc. grandis* (C. Bryan × P. grandifolius).—*Pc. Schroederiana* (C. gigas × P. Wallichii). Sepals and petals lilac, the lip claret-colored. G.M. 44:387.—*Pc. Sedeniana* (C. Veitchii × P. grandifolius). Sepals and petals delicate primrose, flushed at base with pale rose, the lip pale primrose, bright yellow at base and on keels, the lobes flushed with rose

PHAIOCYMBIDIUM (compounded from *Phaius* and *Cymbidium*). *Orchidaceæ*. A group established to contain hybrids between *Phaius* and *Cymbidium*. *P. chardivarensis*—P. grandifolius × C. giganteum.

PHAIUS (Greek, *dark*; referring to the color of the flowers). Often spelled *Phajus*. *Orchidaceæ*. Very large orchids with ample foliage and tall clustered stems terminating in racemes of showy flowers.

Sepals and petals similar, spreading or half-spreading; labellum large, with the lateral lobes inclosing the column, usually gibbous or spurred behind; column slender; pollinia 8. Distinguished from *Calanthe* by the free labellum; from *Thunia* by the leafless bracted scape which does not terminate the leafy axis.—About 20 species, natives of Trop. Asia, Afr., Austral., China, Japan, and the South Sea Isls.

The genus *Phaius* includes both epiphytic and terrestrial representatives. The noteworthy epiphytic types are native of Madagascar, including *P. tuberculosus*, *P. simulans*, and *P. Humboldtii*. However they are not frequently represented in orchid collections. They enjoy a warm moist atmosphere as for vanda. The potting medium should include chopped peat and moss in equal proportion. When potting, small rafts with the potting medium packed around or sections of fern stems, the latter being preferable, should be placed in the center of the pot or basket. The terrestrial species, especially *P. grandifolius*, are well known, being one of the first orchids put under cultivation. It dates as far back as 1778, when it was imported from China. Various species are native to low-lying swampy places of tropical Asia and Australia, and have also become naturalized in the West Indies. They are of easy culture and will grow in an ordinary warmhouse associated with palms. They delight in moisture throughout the year, in a growing medium of sandy fibrous sod-soil, with plenty of organic fertilizer in a dried state mixed with the soil and also in liquid form when in full growth. The main factor to bear in mind is perfect drainage. Plants are increased readily by the division of the dormant pseudobulbs. Upward of thirty garden hybrids are under cultivation at the present time, including some interesting bigeneric forms. (G. H. Pring.)

A. Fls. yellow to brown.

maculatus, Lindl. Pseudobulbs ovate, 2-5 in. high: lvs. 3-4, broadly lanceolate, plicate, 1½-2 ft. long, variegated with numerous yellowish spots: fl.-sts. about 2 ft. high, bearing a raceme of 10-15 yellow fls. each 2-3 in. diam.; sepals and petals half spreading, oblong, obtuse; labellum erect, with the apex recurved, streaked with orange, wavy and crenate, sides convolute over the column, and the base prolonged into a spur half as long as the ovary. Spring. N. India and Japan. B.M. 2719 (as *Bletia Woodfordii*); 3960. L.B.C. 19:1803.—A good spring bloomer.

Wallichii, Lindl. (*P. bicolor*, Lindl. *P. grandifolius*, Lindl., not Lour. *P. grandiflorus*, Reichb. f.). Fig. 2886. Tall: lvs. broadly elliptic-lanceolate, 3-4 ft. long; fl.-sts. erect, 3-5 ft. high, clothed with scales: fls. 4 in. across, varying in color from chocolate-brown to primrose-yellow; sepals and petals spreading, lanceolate, long-acuminate; labellum with an ample elongate tube; limb oblong, acute or acuminate, recurved, margin



2886. Outline of *Phaius Wallichii*. (X nearly $\frac{1}{2}$)
To show botanical structure

crisp; spur slender, incurved. The labellum is less variable in color than the sepals and petals. The base of the tube is yellow, dull reddish beyond, with the throat purple with yellow or red edges on the disk; apex white. Feb.-May. Trop. India, northward to the lower Himalaya. B.M. 4078; 7023. P.M. 6:193. Var. *flavescens*, Hort. Sepals and petals light yellow, front of lip paler.—*P. Blumei*, Lindl., is not very clearly distinguished by botanical characters: the sepals and petals are acuminate, tip of lip acute, spur short and thick. Ceylon.

grandifolius, Lour. (*Blëtia Tankervillei*, R. Br.). One of the oldest orchids in cult. It has smaller fls. than *P. Wallichii*, with less acuminate sepals and petals and a shorter obtuse lip and spur; sepals and petals reddish brown, but variable, white on the outside; labellum white at the apex, throat and disk yellow, sides crimson. China, Austral. B.M. 1924. F.S. 7:738. L.B.C. 1:20. G.C. 1872:733; II. 18:565; III. 3:112. Gn. 3, pp. 183, 221. A.G. 20:279.

AA. Fls. white to rose-color.

Humboldtii, Reichb. f. Pseudobulbs, lvs. and habit like *P. grandifolius* but smaller: fl.-st. 18-20 in. high, erect: fls. white and rose-colored, tinged and streaked with darker red; sepals oblong-acute; petals twice as wide; labellum spurless, lateral lobes striped with brown on a whitish ground, middle lobe light purple, with a yellow callus. Spring. Madagascar. R.H. 1891:204. G.C. II. 26:173. A.G. 12:161. A.F. 6:609.

tuberculatus, Blume. Rhizome thick: pseudobulbs small, bearing several lanceolate lvs. 6-9 in. long; fls. 2-3 in. across, in erect spikes; sepals and petals ovate-oblong, white; lateral lobes of the labellum recurved, yellow, almost covered with brownish crimson spots, margin crenately lobed; middle lobe bifid, white, spotted with purple, having 3 thick, yellow keels; mar-

gin crisp and crenate. Feb. Madagascar. B.M. 7307. R.B. 18:145. G.C. II. 15:341; 18:565; 21:520; III. 13:237; 29:77. G.M. 44:144. Gn. 67:294.—Difficult to grow, requiring a higher temperature than the other species.

mishmensis, Reichb. f. St. 2-3 ft. high, leafy above: lvs. 6-10 in. long, elliptic-lanceolate, plicate: scape from the axils of the lower lvs., together with the loose raceme about 2 ft. long; fls. 2 in. across, pale or dark rose-colored; sepals linear-oblong, acuminate; petals narrower; labellum with rounded side lobes and a subquadrate, spotted middle lobe, which is somewhat 3-parted; spur slender, yellow. Himalayas. B.M. 7479.

P. amboinensis, Blume. Fls. white, with some veining on the lip. Malaya.—*P. Ashworthianus*, Sander. A garden hybrid (*P. Mannii* × *P. maculatus*). Fls. large; sepals and petals clear old gold; labellum large, of the same color, with many radiating chocolate lines, outer surface clear yellow. G.M. 40:551.—*P. caldus*, Lindl. (*Geodorum plicatum*, Voigt). Resembling *P. grandifolius* in habit: sepals and petals dull reddish brown; lip white with tinge of pink, dark purple spot beneath, with yellow on the 2-lobed spur. Malaya.—*P. Chapmannii*—*P. Humboldtii* × *P. Phoebe*. G.M. 46:593.—*P. Cookei* (*P. grandifolius* × *P. Humboldtii*). Sepals and petals nankeen-green, the broad frilled tip yellow at the base with purple-brown markings, the front lobe rose. J.H. III. 46:353.—*P. Cookei*—*P. simulans* × *P. Wallichii*. G.M. 50:134.—*P. Cooperi*, Rolfe. Sepals and petals bright red-brown in front, pale yellow behind, about 2 in. long; lip funnel-shaped, white at first, soon changing to yellow.—*P. fragrans*, Hort. Belonging to same group as *P. tuberculatus*, but fls. smaller and more numerous, in color resembling *P. Humboldtii*.—*P. Adriae* (*P. Blumei* × *P. simulans*). Fls. nankeen-yellow, the base of the lip with rose markings and veined light yellow, the front lobe tinged pink. Gt. 53:1530. R.B. 29:73.—*Norman* (*P. Sanderianus* × *P. tuberculatus*). Sepals and petals cream to pink, lined, the lip with a reddish purple base, veined yellow and with 3 yellow keels, the midlobe rose, blotched purple and tipped white.—*P. oakwoodensis*—*P. Cookei* × *P. Humboldtii*. G.C. III. 28:93.—*P. Opitzii* (*P. Wallichii* × *P. Humboldtii*).—*P. Sanderianus*, Hort. Fls. 8 in. wide or more, the sepals and petals copper-red, the lip with a yellow base, crimson center, and white midlobe.—*P. schneobrunnensis*—*P. grandifolius* × *P. assamicus*.—*P. simulans*, Rolfe. "The epiphytal species known in gardens under the name of *P. tuberculatus* is not the original plant, and has been renamed *P. simulans* in allusion to the remarkable resemblance which its fls. bear to those of the original species."

GEORGE V. NASH.†

PHALACRÆA CELESTINA, Regel: *Ageratum conyzoides*.

PHALÆNOPSIS (Greek, *moth-like*; suggested by the large white flowers of some species). *Orchidaceæ*. This genus, called by Lindley "the grandest of all orchids," contains some of the most useful species to be found in the orchid family; greenhouse.

Of monopodial growth, having short sts. which increase slowly in length: lvs. few, thick, leathery, often mottled: infl. a raceme or panicle, large, or not longer than the lvs.; sepals spreading, the lateral ones more or less united with the base of the column; petals about as large as the sepals or very much broader; labellum variously shaped but united with the base of the column.—About 50 species natives of the hot regions of India and the Malay Archipelago, growing on trunks of trees and sides of rocks under conditions of high temperature and great moisture. The fls. are remarkably beautiful in form and color. Those of the larger species are borne in graceful drooping panicles on which they usually all face in one direction.

As all phalænopsis are natives of the most tropical regions of the globe, it is essential that they be well supplied with heat and moisture, particularly during the growing season, from March to October. Care should be taken to avoid direct draught on the plants, but air should be admitted on all possible occasions. This is absolutely necessary to keep the plants in perfect condition. During bright sunshine the plants should be shaded, but given all the light possible to insure good tough ripe foliage by autumn, and large branching flower-spikes may be expected in the flowering season. A close moist atmosphere will grow large soft foliage, but small flower-spikes usually result. Plants may be grown suspended from the roof, not too near the glass, or on benches, in pots, in baskets, in pans, or on

blocks or rafts. They are somewhat whimsical, and once a house is found in which they succeed, they should not be moved. During the growing season the temperature should be kept as uniformly as possible between 70° and 75° F., allowing a rise of 10° with sun heat. The minimum night temperature, in winter, should be 60° to 65° F. Good and ample drainage is absolutely necessary, clean potsherds and lumps of charcoal being the best material, and only sufficient peat fiber and sphagnum in equal proportions should be used to keep the plant firmly in position, as the roots will eventually cover the receptacle in which they are growing. When potting, always give the plant its natural inclination, which is invariably sufficient to prevent water remaining in the axils of the leaves, a condition which should be carefully guarded against, either from watering or from drip. Always keep the plant well raised, when potting, to insure quick and perfect drainage. Sponging the leaves occasionally will keep the plants clean and prevent the attack of thrip and red-spider. The propagation of phalænopsis is a very slow process, as the plants rarely afford opportunity for division. Sometimes young plants form on the old flower-stems, and these should be left until they make root, at which stage they may be removed, potted, and carefully watered until root-action begins in the new material. (Alfred J. Loveless.)

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2887. *Phalænopsis amabilis*. (×½)

KEY TO THE SPECIES.

- A. *Petals much broader than the sepals.*
B. *Labellum with apical appendages; rostellum short.*
C. *Apical appendages cirrhus.*
D. *Middle lobe very narrow.*..... 1. *amabilis*
DD. *Middle lobe trowel-shaped.*..... 2. *Aphrodite*
CC. *Apical appendages short, horn-like.*
D. *Lvs. green.*..... 3. *intermedia*
DD. *Lvs. mottled, at least when young.*
E. *Fls. white.*..... 4. *Stuartiana*
EE. *Fls. rose-purple.*..... 5. *Schilleriana*
BB. *Labellum without apical appendages; rostellum long.*..... 6. *Lowii*
AA. *Petals scarcely or not at all broader than the sepals.*
B. *Claw of the labellum with horn-like appendages below the lateral lobes.*..... 7. *Esmeralda*
BB. *Claw of the labellum without appendages.*
C. *Apex of the labellum notched.*..... 8. *amethystina*
CC. *Apex of the labellum entire.*
D. *Rachis compressed: bracts fleshy.*
E. *Middle lobe of the labellum fleshy, rounded.*..... 9. *violacea*
EE. *Middle lobe of the labellum crescent-shaped.*..... 10. *Cornu-cervi*
DD. *Rachis terete.*
E. *Labellum laterally compressed, fleshy.*..... 11. *speciosa*
EE. *Labellum expanded.*
F. *Middle lobe densely hairy.*..... 12. *sumatrana*
FF. *Middle lobe pilose.*..... 13. *Luëddemanniana*
FFF. *Middle lobe smooth.*..... 14. *Parishii*
G. *Labellum crested.*..... 15. *rosea*
GG. *Labellum not crested, but provided with a fleshy callus.*..... 15. *rosea*

1. *amabilis*, Blume, not Lindl. (*P. grandiflora*, Lindl.). Fig. 2887. Lvs. long, pale green: fls. variable in size, sometimes about 5 in. across, pure white with stains of deep yellow and a few purple spots on the labellum and on the column; dorsal sepals ovate to oblong, lateral sepal lanceolate; petals rounded-fan-shaped; lateral lobes of the labellum obliquely cuneate, incurved, middle lobe very narrow with yellow cirrhi. Autumn. Malay Archipelago. B.M. 5184. G.C. 1848: 39; II. 26:213. Gn. 19, p. 305; 24, p. 560; 34, pp. 516, 517. R.H. 1860, pp. 238, 239; 1897, p. 151. A.G. 16:271. A.F. 27:1137; 30:610, 1079. F.E. 33:716. Gng. 15:133. Var. *aurea*, Rolfe (*P. grandiflora* var. *aurea*, Warner). Front half of the lateral lobes of the labellum and the entire middle lobe stained deep yellow. Borneo. Var. *Rimestadtiana*, Hort. Fls. larger, pure white, the throat bright yellow. G.C. III. 32:316. Gng. 12:405. *P. Harriette*, Rolfe, is a garden hybrid between *P. amabilis* and *P. violacea*. Fig. 2888. Fls. intermediate between the parents, 4½ in. across; sepals and petals pale yellowish white, suffused and dotted with amethyst-purple toward the base; labellum crimson with an orange crest; cirrhi slightly developed. G.C. III. 2:9. Gn. 38:156. J.H. 42:237.

2. *Aphrodite*, Reichb. f. (*P. amabilis*, Lindl., not Blume). Lvs. elliptic-lanceolate, 1 ft. or more in length, dark green, obliquely retuse: fls. 3 in. diam., pure white, with the labellum streaked and spotted with yellow and red; sepals elliptic-ovate; petals large, rhomboid; lateral lobes oblong, middle lobe trowel-shaped, with white cirrhi. Fls. at various seasons, but most freely during summer. Philippines. B.M. 4297. B.R. 24:34. P.M. 7:49. F.S. 1:40. G.C. 1848:39; II. 26:213. Gn. 31, p. 273; 35, p. 362; 38, p. 157; 48, p. 484. R.H. 1897, p. 150. A.F. 6:89. Var. *Dayana*,

Hort. (*P. amabilis* var. *Dayana*, Hort.), has regular fls. with the lower sepals minutely dotted with crimson, the labellum also being heavily marked with bright crimson. A.G. 21:457. Var. *casta*, Rolfe (*P. casta*, Reichb. f.). Lvs. thinly spotted: fls. like the type, with a rosy tint especially at the base of the sepals and petals, and a few spots at the base of the lateral sepals. —Scarcely distinct from the following, but distinct from the type. Var. *leucorrhoda*, Rolfe (*P. leucorrhoda*, Reichb. f.). Lvs. blotched with gray in irregular bands: sepals and petals flushed with rose, the former yellowish outside; callus yellow, spotted with purple. Philippines. F.M. 1875:166. R.H. 1896:500. Var. *Sanderiana*, Rolfe (*P. Sanderiana*, Reichb. f.). Fls. suffused with rose; labellum variegated with brown, purple, and yellow. Isl. of Mindanao. Gn. 24:270; 57, p. 44. Var. *gloriosa*, Hort. (*P. gloriosa*, Reichb. f.). Fls. white, with a rose-colored spot on the labellum. Gn. 35:362.

3. *intermedia*, Lindl. A natural hybrid between *P. Aphrodite* and *P. rosea*. Resembles *P. Aphrodite* in habit but the fls. are smaller. Sepals oblong, acute, white; petals rhomboid, much larger, white with few rose spots at the base; labellum small, lateral lobes erect, rose-purple spotted with crimson, middle lobe rich crimson, terminating in 2 short horns. Philippines. G.C. III. 52:453. —The same type has been artificially produced by crossing the two parent species. Var. *Brymeriana*, Reichb. f. Sepals and petals white, veined pale amethyst-purple, the lateral sepals purple-spotted at base, the petals purple-stained below; front lobe of lip red-purple. G.M. 43:63. Var. *Pórteli*, Reichb. f. (*P. Pórteli*, Hort.). Fls. large, stained with



2888. *Phalaenopsis Harriettae*. (× about ¼)

rose-purple: lvs. about 1 ft. long, deep green. G.C. II. 5:369, 371. F.M. 1875:162. J.H. III. 30:179; 47:395. Gn. 21:146. G.M. 38:111.

4. *Stuartiana*, Reichb. f. Lvs. elliptic-oblong, obtuse, about 1 ft. long, mottled when young, becoming dull green above and reddish below: panicle large, branched, drooping; fls. 2 in. across; sepals elliptic, obtuse, white or greenish white, the lateral ones speckled with red; petals rounded but obscurely quadrangular, white with few purple dots at base; labellum golden yellow or orange spotted with crimson, white at the tip, lateral lobes obliquely obovate, obtuse, with a pair of cuneate calli between them; middle lobe orbicular, ending in 2 white cirrhi. Jan., Feb. Philippines. B.M. 6622. I.H. 31:540. F. 1882:49. Gn. 22:118; 45, p. 426. G.C. II.

16:753; III. 4:389. J.H. III. 34:157. F.E. 11:393. G. 30:195. —Very near *P. Schilleriana*, but very different in color. Var. *punctatissima*, Hort., has the sepals and petals profusely spotted with purplish red.

5. *Schilleriana*, Reichb. f. Fig. 2889. Lvs. 6–18 in. long, oblong, dark green and mottled with gray above, purple below: panicle drooping, flat, as much as 3 ft. long and nearly as broad, bearing often over 100 fls. each $2\frac{1}{4}$ –3 in. across; dorsal sepals obovate, acute, the lateral ones ovate, rich rose-lilac; petals large, rhomboid, colored like the sepals; labellum colored like the rest of the fl. or paler and often spotted with reddish brown and having a yellow callus; lateral lobes rounded-oblong, with 2 quadrangular calli between them, middle lobe oval, ending in 2 divergent horns. Jan.–March. Philippines. B.M. 5530. F.S. 15:1559. I.H. 10:348; 35:56; 43, p. 154. S.H. 2, p. 47. Gn. 3, p. 183; 22:118; 33, p. 615; 35, p. 363; 38, p. 157; 48, p. 484. G.C. II. 12:301; III. 3:529; 17:367; 37:152. F.M. 1877:257. R.H. 1886:396. A.G. 14:65. G.F. 4:390. A.F. 11:1081. C.L.A. 6:164. F.W. 1876:321. G. 31:19. G.M. 48:151; 52:145. J.H. III. 42:451; 44:551; 52:133.

6. *Löwii*, Reichb. f. Lvs. 4–5, oblong, fleshy, deep green, tinged with purple: panicle slender, 5–20-flid.; fls. $1\frac{1}{4}$ in. diam., white flushed with purple; dorsal sepals broadly ovate, lateral sepals oblong; petals fan-shaped, with a rounded apex; labellum violet-purple, lateral lobes small, reflexed, middle lobe oblong; rostellum very long-beaked. Flowers during summer months. Moulmein (India). B.M. 5351. F.S. 18:1910. Gn. 9:312. G.C. III. 2:745.

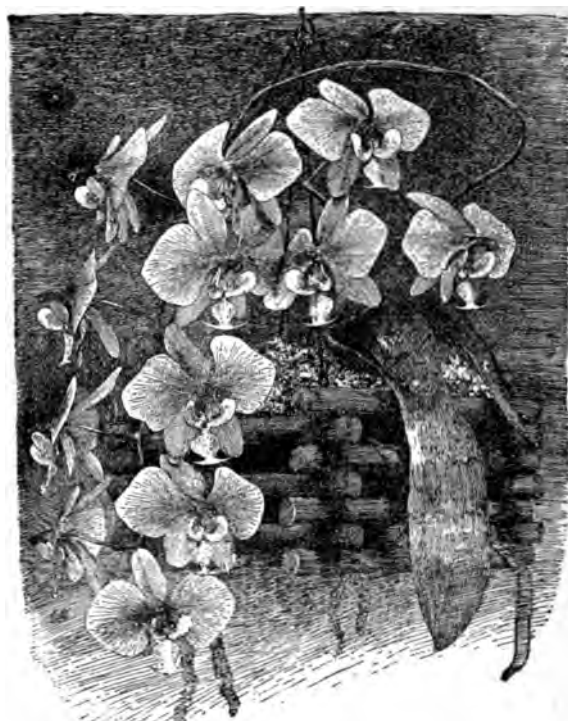
7. *Esmeralda*, Reichb. f. (*P. antennifera*, Reichb. f.). Lvs. oblong, acute, 4–8 in. long, gray-green with few dull purple spots: raceme erect, 6–10-flid., 6–18 in. high; fls. about 1 in. diam., dark or pale purple to white with red streaks; lateral sepals ovate, dorsal sepals obovate; petals obovate; labellum clawed, 3-lobed, lateral lobes ovate to rotund, erect, yellowish; middle lobe broad, obtuse, deep purple; claw with a slender appendage on each side. Cochinchina. B.M. 7196. F.M. 1879:358. R.H. 1877, p. 107.

8. *amethystina*, Reichb. f. A small species with cuneate-oblong lvs.: fls. small, cream-colored with an amethyst labellum; sepals cuneate-oblong, obtuse; petals subequal or a little smaller; lateral lobes of the labellum cuneate; middle lobe obovate, notched. Malay. G.C. 1870:1731.

9. *violacea*, Teijsm. & Binn. Lvs. oblong, 8–12 in. long, light shining green: fl.-stalks not longer than the lvs.: fls. few, 2 in. across; sepals and petals broadly lanceolate, yellowish white, changing to rose-violet toward the base; middle lobe of the labellum fleshy, deep purple, with a yellow callus; side lobes small, erect, purple and orange. May–Oct. Sumatra. F.M. 1879:342. G.C. II. 16:145. J.H. III. 42:537. —Plant of dwarf habit. The fls. remain on the plant a long time. Var. *Schroederiana*, Hort., has the basal half of the segms. bright purple, the color partly broken up into lines. I.H. 32:576. J.H. III. 51:195.

10. *Cornu-cervi*, Blume & Reichb. f. Lvs. about 9 in. long, leathery, oblong; fl.-st. about as long as the lvs., erect, clavate, bearing 6–12 fls.; fls. yellowish green, barred with reddish brown; sepals and petals fleshy, lanceolate, the latter smaller; labellum whitish, lateral lobes erect on the irregular, fleshy, excavated claw, middle lobe crescent-shaped, apiculate. Summer. Trop. Asia, Java, and Sumatra. B.M. 5570 (as *Polychilos Cornu-cervi*).

11. *speciosa*, Reichb. f. Lvs. oblong; fls. stellate, in racemes or panicles, white, blotched with rose-madder; sepals oblong; petals narrower; labellum with erect, linear, toothed, yellow side lobes, and a fleshy, purple and white middle lobe ending in a



2889. *Phalaenopsis Schilleriana*. ($\times \frac{1}{2}$)

hairy cushion. Andaman Isls. (Bay of Bengal). G.C. II. 18:745; 26:277.

12. *sumatrana*, Korth. & Reichb. f. Lvs. pointed, about 6 in. long; infl. about as long as the lvs., 6-10-fld.; sepals oblong, pointed, 1 in. or more in length; petals more cuneate; all yellowish white barred, with bands of reddish brown; labellum short, clawed; lateral lobes erect, meeting and each having a short curved tooth pointing backward; middle lobe oblong, fleshy, white, streaked with violet, very hairy in front. Sumatra and Borneo. B.M. 5527. F.S. 16:1644. G.C. 1865:507.

13. *Lueddemanniæna*, Reichb. f. A small plant, with thick, oblong fleshy lvs. 6-8 in. long; infl. about as long as the lvs., with few handsome fls. near the top; fls. 2-3 in. across; sepals and petals oblong-acute, white, marked with transverse bars, those at the base being amethyst, while the upper ones are brown; labellum deep violet, with yellow blotches on the side lobes; middle lobe oblong; side lobes erect, ligulate, deeply 2-toothed. Feb., March. Philippines. B.M. 5523. F.S. 16:1636. R.H. 1872:390. F. 1865:257. G.C. III. 39:259. R.B. 26:169.—The old fl.-sts. of this plant produce young plants by which the species may be easily increased. Var. *ochracea*, Reichb. f. A form with yellowish fls. and ochre-colored bars. R.H. 1872:390.

14. *Párisii*, Reichb. f. Dwarf: lvs. oblong-lanceolate, acute, 2-4 in. long; fls. in 6-10-fld. racemes scarcely longer than the lvs., crowded; dorsal sepals oblong, lateral broadly ovate, white; petals obovate-spatulate, white; lateral lobes of the labellum small, horn-like, yellow, with purple spots, middle lobe broadly triangular, red-purple, often white on the disk; crest semi-lunar, broken up into subulate filaments in front; the disk has a peculiar appendage ending in 4 long subulate filaments. Burma and Moulmein. B.M. 5815.

15. *rosea*, Lindl. Lvs. oblong, dark green, obliquely retuse; scape about a foot long, nodding, dark purple, bearing 12-14 fls.; sepals and petals ovate, obtuse,

white, tinged with pink in the center; labellum rose-colored, scarcely longer than the sepals; lateral lobes small, lunate, middle lobe ovate. Philippines. B.M. 5212. F.S. 16:1645. G.C. 1848:671. J.F. 3:283.

P. Bértili. Natural hybrid resembling *P. amabilis*, which is one of its parents.—*P. gigantea*, J. J. Smith. Habit like that of *P. amabilis*, but lvs. larger and thicker; fls. in a raceme, whitish, with numerous brown spots. Borneo. G.C. III. 45:306.—*P. Künsteri*, Hook. f. Lvs. up to 4 in. long and 1 in. broad, bright green: raceme loosely 5-8-fld., pendulous; fls. about 2 in. across; sepals and petals similar, spreading, linear to oblong-obovate, yellow, the upper surface marked with brown; lip small, white, streaked with red. Perak. B.M. 7886.—*P. Listeri*, of doubtful authenticity.—*P. Mánnii*, Reichb. f. Fls. about 2 in. across; sepals and petals yellow, blotched and barred with brown, linear-oblong, acute; lip light yellow, the front lobe anchor-shaped, saccate at base; near the side lobes is a 2-horned slender upright plate and a purplish tooth. Assam. J.H. III. 43:97.—*P. Schilleriana-Stuartiana*, see *P. Wiganæ*.—*P. Valentini*, Reichb. f. Plant with habit of *P. violacea*: sepals purple, cuneate-oblong, the lateral ones white at base; petals like lateral sepals or purple-barred; lip short, clawed, mauve, white and yellow. Malaysia.—*P. Wiganæ*—*P. Schilleriana* \times *P. Stuartiana*. G.C. III. 27:83. G.M. 43:63.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

PHALANGIUM LILIÆSTRUM: *Paradiæa*.

PHALARIS (old Greek name for a grass). *Gramineæ*. Stout hardy ornamental grasses.

Spikelets 1-fld., in heads or spike-like panicles; glumes boat-shaped, awnless; 2 minute sterile lemmas at base of perfect floret.—Ten species, mostly of S. Eu., one native throughout the northern part of N. Amer., a variety of which is ribbon-grass. *P. canariensis*, CANARY-GRASS, which is cult. in Eu. for bird-food or as a cereal, sometimes escapes along roadsides. This annual species, on account of its variegated ovate spikes, is worthy of cult. as an ornamental grass.

arundinæa, Linn. REED CANARY-GRASS. A tall perennial (2-6 ft.), with flat $\frac{1}{2}$ in.-wide lvs. and an elongated spike-like panicle (open in anthesis) of whitish spikelets, native throughout northern Amer. in wet ground, where it is an important forage grass.—Recommended for planting in parks and grounds along the banks of streams or artificial ponds.



2890. Ribbon-grass.—*Phalaris arundinacea* var. *picta*.

Var. *picta*, Linn. (var. *variegata*, Hort.). REIBON-GRASS. GARDENER'S GARTERS. Fig. 2890. Lvs. longitudinally striped with white. Commonly cult. for ornament and sometimes run wild about old places.

The name "*P. commutata*, or TOOWOOMBA CANARY-GRASS," has appeared in recent agricultural literature, as an intro. from Austral. The grass has been identified as *P. bulbosa*, Linn. (See Kew Bull. Misc. Inf. 1909:289).

A. S. HITCHCOCK.

PHALOCÁLLIS (Greek words referring to the delicacy of the cone formed by the crests). *Iridaceae*. Referred by Baker and others to *Cypella*. The plant offered as *P. plumbea*, Herb., by Dutch bulb-growers is *Cypella plumbea*, Lindl., a South Brazilian species described in Volume II, page 940. B.M. 3710 (flowers chiefly lilac). F.S. 4:395 (chiefly light blue); 14:1466 (*flore striato*, veined and flushed with rich purple shades on a white ground).

PHÁRBITIS: *Ipomaea*.

PHASEOLUS (ancient Latin name, somewhat altered, of a bean). *Leguminosae*. BEAN. The common garden and field beans, and also some species grown for ornament.

Annual or perennial mostly twining herbs, or some of them woody at the base: lvs. mostly pinnately 3-foliate, stipellate; peduncles axillary, bearing clusters of white, yellow, red, or purplish papilionaceous fls. and more or less compressed (flat-sided) several- to many-seeded 2-valved pods. From its allied genera, *Phaseolus* is separated by minute characters of calyx, style, and keel. In *Phaseolus*, the style is bearded along the inner side and the stigma is oblique or lateral, rather than capitate on the end of the style; the keel is coiled into a spiral body, including the 10 diadelphous (9 and 1) stamens.—Many species have been described, mostly of warm countries (*P. polystachyus* is native in U. S., but not cult.), but probably not more than 150 that can be clearly separated as species.

The cultivated species of *Phaseolus* are all tropical or subtropical in nativity. Therefore they must not be subjected to frosts. Most of them are garden annuals which are planted after the danger of freezing weather has passed and the ground is well warmed. For the culture of the domesticated forms of *Phaseolus*, see



2891. *Phaseolus acutifolius* var. *latifolius*.

the article on *Bean*. See, also *Canavalia*, *Glycine*, *Mucuna*, *Soybean*, *Stizolobium*, *Vicia*, and *Vigna*.

Eleven species of *Phaseolus* are now known to be cultivated to a greater or less extent in various parts of the world. Further explorations in Mexico, Central and South America and in eastern Asia will very

probably show that a number of other distinct species not here enumerated have been domesticated locally.

The eleven species here treated fall into two groups, the one perennial, the other annual, at least in the United States.



2892. *Phaseolus multiflorus*. (× 1/4)

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<i>cirrhosus</i> , 2.		

I. PERENNIAL BEANS.

This group includes three species, none of which is now commonly seen in cultivation.

- A. *Plant tall-twining, with large, fragrant, showy fls.: root not tuberous.*
- B. *Fls. light purple to yellowish, in axillary racemes.*

1. **Caracalla**, Linn. CARACOL. SNAIL-FLOWER. CORKSCREW-FLOWER. Lfts. broadly rhombic-ovate, pointed or acuminate: fls. large and fleshy, very fragrant, the large keel coiled like a snail-shell. Tropics, probably of the Old World. B.R. 341. V. 2, p. 370.—Naturalized in parts of Calif., where it grows 20 or more ft. high, sometimes becoming a nuisance. It is an old-fashioned glasshouse plant in cold climates, but is now rarely seen. *P. Bertonii*, Hort., recently intro. from Paraguay, although a close relative, is probably specifically distinct from *P. Caracalla*.

- BB. *Fls. red or light blue, in axillary dense capitate clusters.*

2. **adenanthus**, Mey. (*P. amœnus*, Soland. *P. truxillensis*, HBK. *P. cirrhosus*, HBK.). Foliage much

like that of the last, the lfts. ovate and somewhat acute: fls. very showy, red (or light blue?), fragrant: pod 4-6 in. long, usually curved. Tropics.

AA. *Plant low, spreading or trailing, annual above the ground: root tuberous: fls. small, in loose axillary, interrupted racemes.*

3. *retusus*, Benth. METCALF BEAN. Root very large and fleshy, running deep into the ground: st. roughish: lfts. rhombic to oblong, mostly obtuse and often retuse, rough on both sides, with prominent veinlets, especially beneath: fls. reddish purple: pod flat, short, broadly oblong, somewhat curved. Texas, west and south.—Lately recommended as a forage plant in the dry regions of the S. W. Not promising in Ariz. at elevations less than 4,000 ft. The lvs. are thick and heavy and adapted to dry, hot climates. Sts. grow 8-10 ft. or more long on the mountains where it is a favorite food for deer.

II. ANNUAL GARDEN BEANS.

The species of this group are all annuals with the exception that *P. multiflorus* and *P. lunatus* are perennial in tropical countries. The somewhat thickened roots of the former sometimes live over in the South, but both species are strictly annual in the northern and middle states.

A. *Fls. yellow.*

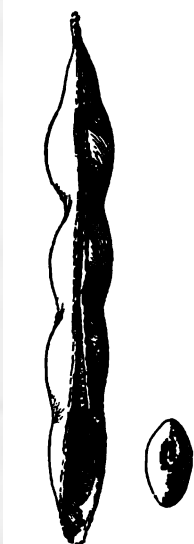
B. *Lfts. distinctly lobed.*

c. *The lfts. 3-5-cut for one-fourth to one-half their length.*

4. *aconitifolius*, Jacq. MOTH BEAN. A diffuse trailing plant, 1-2 ft. long with slender sts. loosely covered with rather stiff, brown hairs: lfts. 3-5-lobed at the apex for one-fourth to one-half their length, the lobes narrow; stipules small, narrow, and pointed: fls. very small, yellowish, in heads on the ends of hairy axillary peduncles: pod becoming 2 in. long, nearly cylindrical, glabrous; seeds clay-colored, cylindrical, distinctly elongated, average weight about .03 gram; hilum less than $\frac{1}{4}$ in. (2 mm.) long. India, where it is cult. for human food and



2893. Barteldes Bush Lima. Probably a form of *Phaseolus multiflorus*. ($\times \frac{1}{2}$)



2894. *Phaseolus multiflorus*. White-seeded form. ($\times \frac{1}{2}$)

for forage, but only rarely seen in collections in this country.

CC. *The lfts. shallowly 3-lobed.*

5. *angularis*, Willd. ADZUKI BEAN. Erect, 1-2 ft. high: sts. slightly furrowed, smooth or with scattered retuse hairs: lfts. ovate, shallowly 3-lobed, smooth or slightly roughened with scattered hairs: fls. yellow, in 2's or 3's on axillary peduncles: pods small, cylindrical; seed red, cream, black or mottled, small, average weight about .07 gram, oblong to nearly round, frequently with square end walls, ratio length to thickness (hilum to back) from 1:1 to 1.5:1; hilum $\frac{1}{4}$ in. (2 mm.) long or longer: primary lvs. ovate, their bases truncate or only slightly auriculate, their petioles $\frac{3}{4}$ in. (10 mm.) long or longer. Asia.—Cult. in N. China and



2895. Leaf of *Phaseolus vulgaris*.



2896. Cranberry Pole bean — *Phaseolus vulgaris*. ($\times \frac{1}{2}$)

Japan, where it is eaten boiled with soups or mixed with rice.

BB. *Lfts. entire.*

c. *One wing rolled completely over keel: bases of primary lvs. cordate, their petioles $\frac{3}{4}$ in. long or longer.*

6. *calcaratus*, Roxbg. RICE BEAN. Annual, erect, 1-2 ft. high, in habit much resembling the preceding species: lfts. broadly ovate: fls. yellow, in 2's or 3's in short axillary peduncles: seed varying in color from reddish brown to pale opaque, small, average weight about .05 gram, strongly elongated, ratio length to thickness (hilum to back) 1.75:1 to 2:1, hilum $\frac{1}{4}$ in. (2 mm.) long or longer: primary lvs. narrowly lanceolate. Asia.—Cult. sparingly in China and India, where it is used boiled in soups and with rice.

CC *One wing pressed against but not rolled completely over the keel: bases of primary lvs. rounded or tapering, their petioles less than $\frac{1}{4}$ in. (7 mm.) long.*

7. *atroreus*, Roxbg. MUNG BEAN. Erect or slightly twining (some varieties strongly twining on rich ground), 1-3 ft. high, with furrowed sts. clothed with long brown hairs: lfts. broadly ovate or nearly rhomboid, orbicular, usually entire, thin, short-acute; stipules large, ovate: fls. rather small, yellowish, in clusters of 5-6 on the end of stout hairy peduncles; keel spurred: pod 3 in. or less long, nearly cylindrical, somewhat curved, bearing 10-15 beans; seeds green or golden, small, nearly round; average weight about .05 gram; hilum less than $\frac{1}{4}$ in. (2 mm.) long. Asia.—Cult. in China, where it is used for bean sprouts, vermicelli and gelatine, and extensively in India, also in Persia, Philippines, Japan. The slender pod is hairy at first, but the hairs are deciduous. *P. Mungo*, Linn. (THE URD), a related species, is distinguished by more procumbent habit, long-hairy pods, and oblong blackish seeds.

AA. Fls. not yellow.

B. Petioles of primary lvs. less than $\frac{1}{2}$ in. (7 mm.) long.

8. *acutifolius*, Gray, var. *latifolius*, G. F. Freeman. TEPARY. Fig. 2891. Annual, erect on poor or



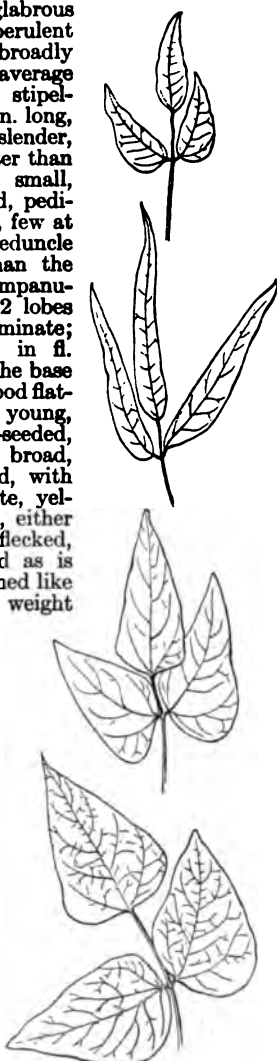
2897. Long-podded forms of *Phaseolus vulgaris*.

dry land, under more favorable growth-conditions sts. recumbent, spreading or twining, $1\frac{1}{2}$ –9 ft. long, glabrous to puberulent: lvs. smooth above with slightly prominent veins beneath, glabrous throughout or slightly puberulent below; lfts. entire, ovate to broadly lanceolate, $\frac{3}{8}$ –2 in. wide (average width $1\frac{1}{2}$ in.), acuminate, stipellate; stipules lanceolate, $\frac{1}{2}$ in. long, striate, appressed; petioles slender, 1–4 in. long; peduncles shorter than the lvs., 2–5-fld.; bracts small, deciduous: fls. medium-sized, pedicellate, white or pale violet, few at the end of an axillary peduncle which is usually shorter than the lvs.; calyx short, broadly campanulate, 4-toothed (the upper 2 lobes united into 1), teeth acuminate; banner broad, emarginate, in fl. more than half reflexed, at the base biauriculate, $\frac{1}{8}$ – $\frac{3}{8}$ in. long; pod flattened and coriaceous when young, when mature papery, 2–7-seeded, 2–3½ in. long, $\frac{1}{8}$ – $\frac{3}{8}$ in. broad, straight or slightly curved, with prominent beak; seeds white, yellow, brown, or bluish black, either self-colored or variously flecked, round-oval to nearly round as is the navy, to strongly flattened like a diminutive lima; average weight .10–.20 gram. S. W. U. S. and Mex.—Cult. by the Indians and Mexicans of the southwestern desert region. Recently intro. by the Arizona Agric. Exp. Sta. as a very promising drought-resistant dry shell bean for hot semi-arid regions. See *Bean*, Tepary, p. 462; also *Ariz. Agric. Exp. Sta. Bull.* No. 68 (1912).

BB. Petioles of primary lvs. $\frac{3}{8}$ in. (10 mm.) long or longer.

C. Cotyledons not raised above the ground in the seedling.

9. *multiflorus*, Willd. SCARLET RUNNER BEAN. DUTCH CASE-KNIFE BEAN (a white variety). Figs. 2892–2894. Root thickened and tuberous, sometimes perennial in the S., but perishing in the N.: plant tall,



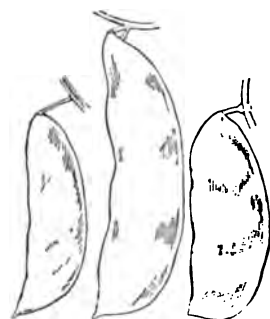
2898. Leaves of *Phaseolus lunatus*. Two upper ones, Willow Leaf, a very narrow-leaved form of the Sieva type; middle one, Potato Lima; lowest one, Large White Lima, the two latter being var. *macrocarpus*.

twining and slender, minutely pubescent: lvs. large; lfts. thin, terminal lfts. often 3 in. or more wide, rhombic-ovate and acute, scabrous-pubescent: fls. rather large and showy, on long naked racemes, in the Scarlet Runner type red, in the Dutch Case-Knife white, the keel not distinctly projecting: pods long (3–6 in.), with curved slender tip; seeds large ($\frac{1}{2}$ in. long or longer), much flattened or nearly cylindrical, less than twice as long as broad, not usually reniform, no conspicuous lines radiating from the hilum, color red or mahogany, and black in the Scarlet Runner, white in many other forms: primary lvs. ovate or cordate, the base deeply auriculate, petioles 1 in. or more long. S. Amer. or Mex., but now widely spread.—The Scarlet Runner form is popular as an ornamental vine for arbors and to cover windows, sometimes being known as Flowering Bean or Painted Lady. The Dutch Case-Knife is a vegetable-garden plant, grown for its beans. Various forms of the plant are grown for food by the Mexicans and these sometimes appear in our western country. Here belong the Aztec or prehistoric beans, now grown sparingly in N. Ariz., which are said to have originated from seed found in caches among the prehistoric cliff-dwellings. Melde's Perennial and Irvine's Hybrid beans are apparently white-fl. forms. The color of fl. and seed seems always to be associated in this species. A dwarf or bush form, probably of *P. multiflorus*, was intro. a few years ago as Bartelde's Dwarf Lima (see Bull. No. 87, Cornell Exp. Sta.). It is not unlikely that more than one species is passing as *P. multiflorus*, some of the Mexican forms being imperfectly understood.

CC. Cotyledons raised above the ground in the seedling stage.

D. Fl.-bracts large, conspicuous, oval.

10. *vulgaris*, Linn. COMMON BEAN. KIDNEY BEAN of the English. HARICOT of the French. Figs. 2895–2897. Erect or twining (on poor or dry soil many varieties are erect which are twining in more moist or fertile land; some varieties, however, retain the bush form under the most favorable conditions): mature plants more or less pubescent: lfts. rhombic-ovate or ovate, acuminate: peduncles shorter than the petioles, few-fld. at or near the apex: fls. small, white, yellowish or blue-purple; pod slender, somewhat curved, provided with a straight or curved tip, fleshy when young and either green or light yellowish wax-color; length of mature seed less than $\frac{1}{2}$ in., average weight more than .20 gram, no conspicuous lines radiating from the hilum: primary lvs. entire, cordate, deeply auriculate, dull green, slightly rough from fine scattered hispid pubescence, their petioles distinctly pubescent.—Both seed and plant characters very variable. There are probably about 200 distinct types, which include between 400 and 500 named commercial varieties. Here are included all of both bush and running forms of which the pods are used as green snap beans as well as the dry shell-bean type like the Navy, Boston Pea, and California Tree bean. The seven species of common beans (*P. vulgaris*, Savi, *P. compressus*, Mart., *P. gonospermus*, Savi, *P. carinatus*, Mart., *P. oblongus*, Savi, *P. ellipticus*, Mart., *P. sphaericus*, Mart.) which were separated by George von Martens (Die Gartenbohnen, 1860) according to the shape and size of



2899. Pods of Sieva, Large Lima, Potato Lima. The last two are forms of *P. lunatus* var. *macrocarpus*. (× $\frac{1}{3}$)

the seeds, are now recognized by botanists as different varieties of *P. vulgaris*, Linn. For cult., see *Bean*. For descriptions of commercial varieties see H. C. Irish, "Garden Beans Cultivated as Esculents," Missouri Bot. Garden, 12th Ann. Rept. (1901), pp. 81-165; W. W. Tracy, Jr., "American Varieties of Garden Beans," U. S. Bur. Plant Ind., Bull. No. 109 (1907), pp. 5-173; C. D. Jarvis, "American Varieties of Beans," Cornell Bull. No. 260 (1908), pp. 149-245.



2900. Henderson Dwarf Lima, a form of *Phaseolus lunatus*. ($\times \frac{1}{2}$)

white, brown or mottled, conspicuous lines radiating from the hilum, more than $\frac{1}{2}$ in. long: primary lvs. not lobed, in form ovate or cordate, bases deeply auriculate, upper surfaces smooth and somewhat shiny, their petioles almost perfectly glabrous. Trop. Amer.—Widely cult. in warm countries, and prized for its earliness and prolificacy. It gives rise to dwarf or bush forms, as the Dwarf Carolina, Henderson Bush Lima. Common in American gardens. Var. *macrocarpus*, Benth. (*P. inamènus*, Linn. *P. lmensis*, *P. saccharatus*, *P. facindus*, *P. latistilius*, Macfadyen. *P. puberulus*, HBK. *P. Xuarézii*, Zucc.). LIMA BEAN. Figs. 2898, 2899. Distinguished from the Sievas by tall, robust growth and late ripening: lfts. large and thick, ovate-lanceolate: pods fewer to the raceme, straight or nearly so, without a prominent tip, not readily splitting at maturity; beans very large, white, red, black, or speckled. S. Amer.—Widely grown in the tropics, and one of the richest of beans. Unreliable in the northern states because of the short, cool seasons. There are 2 forms cult. in the U. S.: Flat or Large-seeded limas, with seeds very flat and veiny and more or less lunate in shape, and very broad flat pods, with a distinct but not prominent point, and broad ovate lfts.; Potato limas, with smaller tumid seeds, shorter and thicker pods, with a very short point, and long-ovate, tapering lfts., with angular base. In both these groups there are dwarf or bush forms,—Burpee Dwarf Lima in the former, and Kumerle Dwarf Lima in the latter. The lima bean is perennial in the tropics. See *Bean*, *Lima*.

DD. Fl. bracts small, inconspicuous, lanceolate.

11. *lunatus*, Linn. SIEVA or CIVET BEAN. Figs. 2898-2901. Small and slender, usually not climbing very high: lfts. thin, short and broad, ovate pointed (except in special forms as the Willow-leaf): fls. of medium size, wings and keel white or whitish, banner greenish, containing chlorophyll, of different texture from the wings and keel, in axillary racemes: pods small and papery, 2-3 in. long, much curved on the back and provided with a long tip, splitting open when ripe and the valves twisting; beans small and flat,

GEO. F. FREEMAN.

PHAYLÓPSIS (Greek, *worthless*, and *appearance*). Also spelled *Phaulopsis*. Syn., *Micranthus*, Wendl., not Eckl. *Acanthaceae*. Small shrubs, probably not now in cult.: lvs. often oblique, those in one opposite pair unequal, elliptic, entire, or crenate: infl. in cylindric or

ovoid spikes, each broad floral lf. inclosing a contracted cyme of usually 3 fls.; calyx 5-lobed nearly to the base; corolla small, 5-lobed; stamens 4: caps. ellipsoid, compressed, usually 4-seeded. About 15 species, Afr., Mascarene Isls. and India. *P. parviflora*, Willd. Pubescent: st. 1-2 ft. high, branched: lvs. acuminate at both ends, nearly entire: calyx hairy, 2 anticeous segms. linear-ligulate; corolla white or purplish, tube funnel-shaped at the top; ovary glabrous. Trop. and S. Afr., Mascarene Isls., and India. B.M. 2433 (as *P. longifolia*).

PHEGÓPTERIS (Greek, *beech-fern*). *Polypodiaceae*. BEECH, OAK or SUN FERN. A group of ferns like *Dryopteris* in habit and latterly usually included in that genus, but with no indusia, the sori being entirely naked. There are numerous Trop. American and Sandwich Island species worthy of cult. in warmhouses. There are 3 native hardy species sometimes offered in the trade, the first, second, and fourth in the following list. For cult., see *Ferns*.

A. Lvs. small or medium-sized, at most tripinnatifid. (Native hardy species.)

B. The lvs. bipinnatifid, broadly triangular.

hexagonóptera, Fée (*Polypodium hexagonópteron*, Michx.). Lvs. 9-15 in. long, usually broader than long, pale green; lower pair of pinnæ deflexed and set forward; sori marginal. E. U. S.—Suitable for shaded banks with good soil and fair moisture.

polypodioides, Fée. Lvs. 5-9 in. long, longer than broad, dark green, slightly hairy beneath; sori nearer the margin than the midrib. Eu. and N. E. N. Amer. G.M. 58:297 (as *Polypodium phegopteris*).—Like preceding in cultural requirements.

BB. The lvs. tripinnatifid, lanceolate.

alpéstris, Mett. Lvs. 1-2 ft. long, 6-8 in. wide, with numerous finely cut lanceolate pinnæ, the lobes toothed; thinly herbaceous. Eu. and N. W. Amer.—Habit of *Athyrium* (or *Asplenium*) *Filix-femina* and is probably an *Athyrium*.

BBB. The lvs. ternately tripinnatifid.

Dryopteris, Fée. OAK FERN. Lvs. triangular, 3-9 in. each way, the lowest pinnæ nearly equal to the terminal, giving the lf. a ternate appearance Eu. and N. Amer.—Grows in damp places in nearly pure leaf-mold.

AA. Lvs. several feet long, decomposed.

Keraudreniana, Mann. Lvs. several feet long, decomposed, with light brownish polished stalks and straw-colored rachides; texture herbaceous; sori near the margins of the segms. Sandwich Isls.—A greenhouse species. This species has also been advertised under the name of *Polypodium*.

L. M. UNDERWOOD.
R. C. BENEDICT.†

PHELLODÉNDRON (Greek, for *cork*, and *tree*, alluding to the corky bark). *Rutaceae*. CORK TREE. Ornamental trees, grown for their handsome foliage.

Deciduous: winter buds naked, inclosed by the base of the petiole: lvs. opposite, petioled, without stipules, odd-pinnate, with opposite crenulate lfts.: fls. dioecious, in terminal panicles, or the staminate fls. nearly corymbose; sepals and petals 5-8, ovate-lanceolate; stamens 5-6, longer than petals; ovary 5-celled, with a short thick style: fr. a black drupe with 5 small 1-seeded stones.—Five or 6 closely related species in E. Asia.



2901. Sieva bean.—*Phaseolus lunatus*. ($\times \frac{1}{2}$)

The cork trees are usually medium-sized trees with rather stout spreading branches, forming a round broad head, with large leaves of aromatic odor when bruised and turning yellow in autumn, and with inconspicuous greenish flowers followed by black berry-like fruits remaining on the tree a long time after the leaves have fallen. *P. amurense* and *P. sachalinense* are hardy North, while the other species seem somewhat tender but have proved hardy as far north as Massachusetts. They are of rapid growth when young and seem to grow in almost any kind of soil. The first-named species has been recommended as a street tree for western cities, as it resists drought and heat in summer and seems not to be attacked by insects. Propagation is by seeds, which are produced freely when both sexes are planted, and by root cuttings dug up in fall and stored during the winter in moist sand or sphagnum; cuttings taken from the tree in July with a "heel" of older wood will root in gentle heat.

A. Lvs. glabrous beneath or with a few scattered hairs on the midrib, glaucescent or glaucous.

amurense, Rupr. AMOOR CORK TREE. Tree, to 50 ft.: bark of the trunk light gray, corky, deeply fissured: 1-year-old branchlets orange-yellow or yellowish gray, almost glabrous: lfts. 5-13, ovate to ovate-lanceolate, narrowed or rounded at the base, long-acuminate, minutely crenulate, and ciliate, dark green and lustrous above, glaucescent and glabrous beneath or with a few scattered hairs near the base of the midrib, 2-4 in. long: infl. puberulous: fr. globose, black, about $\frac{1}{8}$ - $\frac{1}{2}$ in. across, with a strong turpentine-like odor when bruised, in broad panicles, 2-3½ in. across. June. N. China, Amurland, Japan. S.T.S. 1:93. S.I.F. 2:33. Var. **albo-variegatum**, Schwerin. Lvs. variegated with large white blotches.—A hybrid between this species and *P. japonicum* has been observed in the Botanic Garden at Lund, Sweden.

sachalinense, Sarg. Tree, to 50 ft.: bark of the trunk dark brown, slightly fissured and broken into thin plates, not corky: 1-year-old branchlets reddish brown: lfts. 7-11, ovate to ovate-oblong, acuminate, cuneate or rounded at the base, minutely crenulate and glabrous or sparingly ciliate on the margin, dull green above, glaucescent beneath and glabrous or nearly so, 3-5 in. long: infl. nearly glabrous: fr. black, $\frac{1}{4}$ in. across or slightly more, in broad panicles 2-3½ in. across. June. Saghalin, Korea, N. Japan, W. China. S.T.S. 1:94.—This is the most satisfactory and hardiest species in cult.; it forms a tall trunk with a broad crown.

AA. Lvs. pubescent beneath, at least on the veins, and pale green or grayish green.

B. Infl. as broad or nearly as broad as high: ovary glabrous.

Lavallèi, Dode. Tree, to 30 or occasionally to 50 ft.: bark corky: 1-year-old branchlets purplish brown: lf.-rachis puberulous or pubescent; lfts. 5-13, elliptic-ovate to oblong-lanceolate, acuminate, cuneate at the base, minutely crenulate and ciliate, dull yellowish green above, pubescent beneath while young, at maturity often only on the veins, 2-4 in. long: infl. puberulous: fr. black, $\frac{1}{2}$ in. across, in rather loose broad panicles 2½-4 in. across. June. Cent. Japan. I.T. 5:171 (as *P. amurense*).—Often confused with *P. japonicum* and cult. under that name.

japonicum, Maxim. Tree, to 30 ft., with slightly fissured dark brown bark, not corky: 1-year-old branches reddish brown: lf.-rachis densely villous or tomentose; lfts. 9-13, ovate to ovate-oblong, acuminate, truncate or subcordate and very unequal at the base, minutely crenulate and ciliate, dull green above, villous beneath all over, more densely on the veins, 3-4 in. long: infl. hoary-tomentose: fr. black, nearly $\frac{1}{2}$ in. thick, in broad panicles 2-3½ in. across. June. Cent. Japan. S.T.S. 1:95.

BB. Infl. distinctly higher than broad: ovary pubescent.

chinense, Schneid. Tree, to 30 ft.: bark dark grayish brown, slightly fissured, not corky: 1-year-old branchlets purplish brown: lfts. 7-13, oblong-ovate to oblong-lanceolate, acuminate, rounded or broadly cuneate at the base, dark yellowish green above, villous beneath, 3¼-5½ in. long: infl. densely pubescent: fr. black, nearly $\frac{1}{2}$ in. across, in panicles about 1-2½ in. broad and 2-3 in. long. Cent. China. Var. **glabriusculum**, Schneid. (*P. sinense*, Dode). Lfts. pubescent only on the veins beneath. Cent. and W. China. ALFRED REHDER.

PHELYPÆA (after Louis and Hier. Phelipeaux). Also spelled *Phelipæa*. *Orobanchaceæ*. Herbs, puberulent or glabrous, from a thick short few-scaled base: scapes simple, elongated, remotely few-scaled or the elongated peduncles naked, scape-like, always 1-fl., bractless; calyx 5-parted, broad-campanulate, lobes acute, unequal; corolla-tube broadly ventricose, incurved, limb sub-2-labiate, with 5 broadly rounded not very unequal lobes, anterior lip at base gibbous or with 2 broad glandulose-pubescent spots; stamens included; ovary with 4 placentæ: fr. a perfect 2-valved acute, ovate caps.—About 5 species, chiefly in the Orient, but also in N. Afr. and Asia. *P. foliata*, Lamb. Parasitic leafless herb 1-1½ ft. high: sts. simple, rather stout, glandular-puberulous, reddish: fl. solitary, terminal, ebracteate; calyx campanulate, unequally 5-lobed, usually somewhat 2-lipped, lobes oblong or ovate, deep red or chestnut-brown; corolla ringent, tube widely and obliquely campanulate, orange flushed with red outside, limb 2-lipped, reddish yellow outside, brilliant crimson within, the throat with 2 black hirsute spots: fr. a wide ovate caps. nearly $\frac{1}{2}$ in. long. Caucasus. It has been raised in botanic gardens in Eu.

F. TRACY HUBBARD.

PHENOLOGY (contraction of *phenomenology*; that is, the science of phenomena) is the study of the relationships between the climate of any place and the annual periods of plants and animals. Plants vegetate, bloom, and ripen fruit at more or less definite seasons, each after its kind; animals mate, bear young, migrate and hibernate each also after its kind; but these recurring events are related to the climate in which these things live: with these inter-relationships phenology has to do. The most complete means of comparing the climate of one year with that of another are the life-events of the animals and plants of the years. Thermometrical readings are the customary measures, but the thermometers record only temperature, whereas local climate is modified by conditions of humidity, cloudiness, the sequence of atmospheric changes, and many subtle agencies which cannot be measured by means of instruments. Living things are the agents that really measure climate. A record of the life-events of living things, therefore, even though imperfect, should contribute to the science of climatology; and incidentally it should contribute much to the science of biology. Records of plant-events are more comparable than those of animal-events, because plants are stationary and have no volition to adapt themselves to inclemencies by means of change of position, diet, or otherwise; therefore, plants emphatically express climatal influence. A record of the first blooming of a given apple tree, for example, during a series of years would give comparable measures of the lateness or earliness of the different seasons. Most so-called phenological observations in this country have been mere records of dates of blooming, leafing, migration of birds, peeping of frogs, and the like, without correlative data respecting the local climate. They are therefore of relatively little consequence to science. In this country the literature of phenology is meager. See Bailey, Essay 17, "Survival of the Unlike," and "Weather Review," Sept. 1896, U. S. Weather Bureau. L. H. B.

PHENOMENAL BERRY: See article on *Loganberry*, page 1900.

PHILADELPHUS (named for the ancient Egyptian king, Ptolemy Philadelphus, who reigned from 285 to 247 B.C.). *Saxifragaceae*. SYRINGA. MOCK ORANGE. Popular ornamental deciduous or rarely half-evergreen shrubs.

Leaves opposite, entire to variously toothed, occasionally slightly revolute, and almost invariably ciliate: fls. often very fragrant, mostly white, a few creamy or with purple or rosy spots at or near the base of the petals, in racemes, or solitary or in cymose groups of 1-6; calyx-lobes, petals, and styles usually 4; stamens numerous: fr. a dehiscent commonly 2-parted 4-valved many-seeded caps.—About 30-35 species have been described. The genus is essentially Asiatic and American. *P. coronarius* is certainly a native of Armenia and the Caucasus, and several varieties of it

the third element in the original heterogeneous syringa. The French also use syringa as the common name of Philadelphus, but in the form *séringat*.

Philadelphus generally blossoms in June; in fact, it is remarkable for the uniformity of the blossoming period, both in cultivation and in its native haunts, throughout the world. Most of the members of the genus are hardy North, except *P. Coulteri*, *P. mexicanus*, and the other Mexican species. They are well adapted to shrubberies and mostly do not grow very high, the tallest being *P. pubescens*, attaining a height of about 20 feet; others, as *P. coronarius*, *P. Zeyheri*, and *P. inodorus*, grow nearly as high, while *P. microphyllus* hardly exceeds 3 feet. If pruning is needed it should be done after flowering, since the flowers appear on the wood formed the previous year. Usually propagation is by hardwood cuttings, or by suckers and greenwood cuttings under glass; also by layers and by seeds, but when several species are growing together they are likely to hybridize.

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- A. Fls. in simple or rarely compound racemes (Nos. 1-20).
- B. Calyx glabrous without, or with some scattered hairs (except in *P. sericanthus* and *P. incanus*).
- C. Pistils little or not at all exceeding the stamens.
- D. Styles separating less than half way down (except often in varieties of *P. Lemoinei*) (Nos. 1-12).
- E. Lvs. some, generally most, of the mature ones more than 1½ in. long.
- F. The lvs. of young succulent shoots and suckers not approaching a circular outline, usually moderately toothed, if at all.
- G. The calyx essentially glabrous without.

1. *nepalensis*, Koehne. Upright shrub to about 5 ft.: lvs. at maturity about 1½-1¾ in. long, ovate-lanceolate, acuminate, evenly and distantly mucronate-denticulate, with white or yellowish tufts of hairs in the axils of lateral veins, especially on lvs. of young succulent shoots and suckers: fls. practically scentless; cup of the calyx and caps. plainly acute to long-pointed at base. June. N.E. Himalayas.

2. *Voie Lactée*. Hybrid between *P. nepalensis* and *P. microphyllus*. Similar to the preceding and superior to it, most readily distinguished by the lvs. of the young succulent shoots and suckers, which are more coarsely toothed, and not so long-pointed: caps. not seen, but probably more rounded at base. June. G.M. 55:554. G.W. 17, p. 103.

3. *pekinensis*, Rupr. (*P. coronarius* var. *pekinensis*, Maxim.). Erect shrub, to 5 ft., closely resembling *P. nepalensis*, but without the characteristic tufts of hairs on lower lf.-surfaces, and usually with purplish petioles. May, June. Mongolia, N. China.



2902. *Philadelphus coronarius*.

extend the range to Japan, and it is wild in Eu., but whether or where it is native is uncertain, because it has undoubtedly sometimes escaped from cult. The genus has 3 roughly defined areas of distribution,—N. Asia and Japan, W. Amer. from Brit. Col. to Calif., S. Atlantic States, and Mex. It has no well-marked characters which may be used to separate the species, which therefore often resemble each other closely and are sometimes connected by intermediate forms. The latest treatment of the genus is in Schneider's *Illustriertes Handbuch der Laubholzkunde*, vol. 1, p. 362 (1905). On account of the great confusion of names in the genus, rather more synonymy than usual is given, but the selection is nevertheless of the names more likely to be met with or to cause confusion. The complete synonymy is far larger.

Syringa, the common name of Philadelphus, is identical with the generic name of the lilac. This arises from the use of *Syringa* by the old herbalists. Thus, in 1597, John Gerarde in his "Herball" gives *Syringa alba*, white pipe, *S. cærulea*, blue pipe, and *S. arabica*, Arabian pipe, the first being *Philadelphus coronarius*, the second *Syringa vulgaris* (lilac), and the third *Jasminum Sambac*. Tournefort, in 1700, selected *Syringa* for the first, but Linnæus, whom we follow, chose to use it for the second. However, Tournefort's usage prevailed in English speech, while the Germans call Philadelphus either *Pfeifenstrauch* (=pipe-shrub, like the herbalists' "pipe," above) or *Jasmin*, perpetuating

4. *Zèyheri* (*P. Kochianus*, Koehne. *P. coronarius* Zèyheri, Schrad.). Hybrid of uncertain origin, probably between *P. coronarius* and *P. inodorus*. Lower than *P. coronarius*: lvs. variable, ovate to ovate-lanceolate, acute to acuminate, with hard-tipped teeth, glabrous or nearly so, or hairy along the veins beneath, those of young succulent shoots and suckers ovate-lanceolate to broadly ovate, sometimes with tufts of hairs on the youngest, as in *P. nepalensis*: fls. white, slightly fragrant or scentless.—A puzzling shrub, at times confusingly similar to *P. coronarius*. June.

5. *Lewisii*, Pursh (*P. columbianus*, Koehne. *P. Gordonianus*, Lindl. *P. californicus*, Benth. *P. cordifolius*, Lange). Upright shrub, to 8 ft., very variable: lvs. about 1-3 in. long, most not more than $2\frac{1}{2}$ in., about $\frac{1}{4}$ -2 (usually not more than $1\frac{1}{4}$) in. wide: racemes of varying length, generally but not always leafy; fls. white, borne in great profusion, in wild plants very fragrant, but, judging by some printed statements, not always retaining the odor under cult. June, July. Brit. Col. to Calif. B.R. 25:32.—Excellent.

6. *coronarius*, Linn. (*P. pallidus*, Hayek. *P. coronarius nivâlis*, Hort.). Figs. 2902, 2903. Shrub, to 10 ft.: lvs. ovate-lanceolate (rarely ovate), generally acuminate, usually rather evenly mucronate-denticulate (exceptionally almost entire), rarely slightly serrate, thickish at maturity, about $1\frac{1}{2}$ -4 in. long, $\frac{1}{2}$ -2 $\frac{1}{4}$ in. broad, slightly hairy beneath: fls. in rather dense racemes, white or more often with a slight creamy tone, very fragrant. May, June. Caucasus, Armenia, and probably S. E. Eu. B.B. 2:186. F.E. 39:75 (habit). J.H. III. 70:471.—This is the common syringa, or mock orange, with less attractive foliage than some, but the delicious fragrance unsurpassed. The following horticultural and 2 wild varieties are cult. Var. *flôre-plèno*, Hort. (*P. coronarius dianthiflorus*, *rosæflorus*, and probably *primulæflorus* and *multiflorus plenus*, and other names), with more or less double fls. Var. *foliis argenteo-marginatis*, Hort., lvs. white-margined. Var. *foliis aureis*, Hort., lvs. golden yellow. Var. *speciosissimus*, Hort. (*P. speciosissimus*, *P. Zèyheri speciosissimus*). Generally lower shrub than the species, with rather uniform and smaller lvs., broadly ovate to rotund. Var. *grandiflorus*, Hort. (*P.*



2903. *Philadelphus coronarius*.—Mock orange. ($\times\frac{1}{2}$)

grandiflorus, Hort.), with larger fls. than in the species, mostly 2 in. or more diam. Not to be confused with *P. inodorus* var. *grandiflorus*, Gray, below. Var. *salicifolius*, Hort. (*P. salicifolius* Hort., in part). Lvs. typically narrowly lanceolate, more or less willow-like, but sometimes, probably by reversion, broadly ovate, more coarsely toothed. Var. *nânus*, Schrad. (*P. nânus*, Hort. *P. salicifolius*, Hort., in part), dense bushy plants, usually not over $1\frac{1}{2}$ ft. high; long cult. and known to flower rarely. Var. *acuminatus*, A. H. Moore (*P. acuminatus*, Lange, *P. satsumi*, *P. satsumânus*, *P. yokohama* or *yokohamæ* of cult.). Lvs. more acuminate than in the species, the tips often bent to one side,

especially in wild specimens, with conspicuous hard-tipped teeth or serrations. Yunnan Province, China, Japan, and Tsu Shima. Var. *tomentosus*, Hook. f. & Thoms. (*P. tomentosus*, Wall. *P. nepalensis*, Lodd.). Shrub, to about 6 ft.: lvs. very hairy beneath. Himalayas and Thibet. Rather unattractive and of uncertain hardness.

gg. *The calyx tomentose*.

7. *sericanthus*, Koehne. Lvs. lanceolate, distantly blunt-toothed or entire, mature ones about $1\frac{1}{2}$ -4 in. long, $\frac{5}{8}$ -2 in. wide, glabrous beneath, or with few scattered hairs: fls. about $\frac{5}{8}$ in. across. June. Hupeh Province, China.—Larger-ldv. specimens have been distinguished as var. *Rehderianus*, Koehne.

8. *incanus*, Koehne. Lvs. ovate, more or less abruptly acuminate, dentate, with 5 principal veins, mature ones $1\frac{1}{2}$ -4 $\frac{1}{4}$ in. long, $\frac{5}{8}$ in. across. June. Hupeh and Szechuan provinces. China.

ff. *The lvs. of young succulent shoots and suckers very large, ovate-lanceolate to orbicular, very coarsely toothed*.

9. *floribundus* (*P. verrucosus floribundus*, *P. grandiflorus floribundus*, Hort.). Hybrid of uncertain origin, probably with *P. coronarius* as one parent. Shrub resembling *P. coronarius*: lvs. generally hairier than in *P. coronarius*, and with characteristically very large, ovate-lanceolate to more often orbicular, generally coarsely toothed lvs. on young succulent shoots and suckers: fls. in racemes of about 5, about 2 in. across, slightly fragrant.

ee. *Lvs. rarely over $1\frac{1}{2}$ in. long (usually from about $\frac{1}{2}$ -1 $\frac{1}{4}$ in.)*.

10. *Lemôinei*. Hybrid of *P. coronarius* and *P. microphyllus*. Shrub with spreading branches, freely flowering: twigs and little branchlets with short hairs: ordinary mature lvs. ovate to ovate-lanceolate, rather uniform, rather small, glabrous or nearly so, acute to acuminate, with a few minute teeth, those of the young succulent shoots and suckers entire or remotely few-toothed, somewhat larger: fls. 2-9, in dense racemes, having a delicate but charming perfume. G.F. 2:617. G.L. 28:225.—The following horticultural varieties are of interest: Var. *erectus*. Flowering branches irregularly ascending, forming a more compact bush and less desirable. M.D.G. 1902:383. *Avalanche*. Graceful shrub, taller than other varieties, branches sometimes as long as 6 ft.: easily distinguished from the other varieties by its lanceolate lvs. G.C. III. 21:89. M.D.G. 1896:293; 1907:379. *Bouquet Blanc*. Lower lf.-surfaces and twigs with scattered hairs, distinctly visible: fls. in bouquet-like masses, not very fragrant. G.M. 55:487. G.W. 17, p. 101. *Candelabre*. Very low shrub, approaching *P. microphyllus* in size, hairy as in the preceding, but with a more open candelabra-like infl. M.D.G. 1896:294. *Mont Blanc*. Normally, probably, the most profusely flowering variety, but very variable in this respect. Hairs scarcely visible, a character at once distinguishing it from all the preceding. Exceedingly fragrant. *Manteau d'Hermine*. Twigs nearly or quite glabrous. *Pavillon Blanc*. Profusely flowering shrub: branches rounded or squarish in habit, twigs hairy: lvs. closely covered with silky hairs beneath. One of the most beautiful, and the sweetest scented of all the varieties, the perfume resembling that of *P. microphyllus*. *Gerbe de Neige*. Calyx hairy. *Boule d'Argent*. Fls. double, stamens mostly sterile, about $1\frac{1}{4}$ in. across, not very sweet-scented; calyx glabrous. Oldest and least desirable of double-fl. sorts. G.C. III. 18:18; 23:331. *Virginal*. Large double fragrant fls., $2\frac{1}{2}$ in. across, or wider. G.M. 54:459. R.H. 1910, pp. 408, 409. *Mer de Glace*. Double fls., similar to preceding. G.W. 17, p. 102. Var. *fimbriatus* is a distinct variety with large fls., petals twisted and deeply serrate. For other varieties of this hybrid consult list, p. 2582.

11. *phantasia* (*P. Lemoiniei Fantaisie*). Hybrid between *P. Coulteri* and an unknown variety of *P. Lemoiniei*. Fls. fragrant, white, tinted with pale rose at the center of the fl.; petals fringed at the edge. June. Var. *purpureo-maculatus*, Hort. Derivative of *P. phantasia*. Lvs. essentially as in *P. Lemoiniei*, but proportionately somewhat broader, with numerous, short, stiff hairs beneath: fls. large, about $1\frac{3}{8}$ –2 in. across, exquisitely fragrant, with a purple spot at base of each petal; calyx with a few short, silky hairs. B.M. 8193.

12. *Étoile Rose*. Hybrid between *P. phantasia* and *P. purpureo-maculatus*. Lvs. small: fls. delicately fragrant, in rounded panicle-like racemes; petals elongate, rose-purple at base, the color diminishing toward the center of the fl. June.

DD. *Styles separated almost or entirely to the base, especially after flowering.*

13. *Conquete*. Hybrid of unknown origin. Lvs. lanceolate to narrowly ovate-lanceolate, glabrous, about 2–3 in. long, $\frac{5}{8}$ – $1\frac{1}{8}$ in. wide, entire, or with a few small teeth, on young succulent shoots and suckers larger, long-acuminate, coarsely toothed: fls. in a more or less compact but not head-like cluster, very large, to $2\frac{3}{4}$ in. across, sweet-scented; the slender thread-like styles cleft almost to the base, especially after flowering, stigmas generally short and small; calyx glabrous without. May, June. G.W. 17, p. 102.

14. *Nuée Blanche*. Hybrid between *P. microphyllus* and *P. nepalensis*. Lvs. ovate to ovate-lanceolate, glabrous, about $1\frac{1}{2}$ – $1\frac{3}{4}$ in. long, $\frac{5}{8}$ – $1\frac{1}{8}$ in. wide, entire or nearly so, on young succulent shoots and suckers ovate, acuminate, conspicuously toothed: fls. not over $1\frac{1}{2}$ in. across, sweet-scented; styles moderately slender, gradually broadening into the stigma; calyx glabrous without. May, June.

15. *Rosace*. Hybrid of unknown origin. Lvs. lanceolate, glabrous, about $1\frac{1}{2}$ – $3\frac{1}{4}$ in. long, $\frac{3}{8}$ to about 1 in. wide, entire, on young succulent shoots and suckers toothed: fls. very large, $1\frac{3}{4}$ – $2\frac{3}{4}$ in. across, sweet-scented; calyx glabrous without. May, June.

16. *Perle Blanche*. Shrub, to about $4\frac{3}{4}$ ft.: lvs. ovate, medium-sized, toothed, with small stiff scattered hairs beneath: fls. partly double, in head-like clusters, sweet-scented; calyx rather hairy without. May, June.

CC. *Pistils far exceeding the stamens.*

17. *Falconeri*, Sarg. Fig. 2904. Shrub, to 8 ft., with slender, arching branches: lvs. ovate-lanceolate, $1\frac{1}{2}$ –3 in. long, $\frac{1}{2}$ –1 in. wide, acuminate, entire or very minutely mucronate-denticulate: fls. in loose racemes of 1–6, fragrant, about $1\frac{1}{2}$ in. across; calyx-lobes very acuminate; petals rather narrow; pistils much longer than the stamens; styles separating as long slender filaments; stigmas scarcely broader than the styles. June. Origin unknown, probably Japanese. G.F. 8:497 (adapted in Fig. 2904). M.D.G. 1899:231. Gng. 8:340.

BB. *Calyx distinctly hairy or glabrate.*

18. *pubescens*, Loisel. (*P. latifolius*, Schrad. *P. grandiflorus*, P. W. Wats., under which name it is often met with, a name commonly also applied to varieties of *P. coronarius* and of *P. inodorus*, *P. nivalis*, and many other species or supposed species; it is also wrongly called *P. Gordonianus*). Shrub, to 20 ft.: bark of old branches grayish, either cracking when old and not peeling, or peeling in little flakes, so that shreds do not remain, of younger branches generally yellowish or greenish yellow: lvs. ovate to broadly elliptic or ovate-lanceolate, $1\frac{1}{2}$ – $4\frac{1}{2}$ in. long, $\frac{3}{4}$ –3 in. wide (those of young succulent shoots and suckers may attain dimensions of $7\frac{1}{4}$ × $6\frac{3}{4}$ in.), acute to acuminate, almost entire to more or less markedly mucronate-denticulate: fls. in long leafy racemes of 5–10, usually distant, somewhat

fragrant. June, July. Tenn., Ala. (last, according to Rydberg). *Souvenir de Billiard* (also cult. under the names *P. Billiardii* and *P. insignis*) is a horticultural variety, with ovate lvs. on the average smaller than in the species, about $1\frac{1}{4}$ – $2\frac{3}{8}$ in. long, erroneously described as a native species. Var. *intectus*, A. H.



2904. *Philadelphus Falconeri*. (× $\frac{1}{4}$)

Moore (*P. intectus*, Beadle). A natural variety with an externally wholly glabrous calyx, and with lvs. glabrous or nearly so. Tenn.

19. *verrucosus*, Schrad. A plant of uncertain origin: if hybrid, the parentage cannot be surmised. Similar to preceding, but bark of old branches purplish red or chestnut-brown, often peeling in shreds, of the younger generally brownish or reddish. June, July. Var. *pendulifolius* is a garden variety with slightly drooping branchlets.

20. *Magdalens*, Koehne. Rather lower, spreading shrub, to about $5\frac{1}{2}$ ft.: the calyx generally with fewer short stiff hairs: otherwise closely resembling the preceding, lvs. inclined to be smaller.

AA. *Fls. borne singly or in clusters of 1–6 at the tips of the branchlets, not in racemes, except occasionally in P. mexicanus.*

B. *Pedicels and, externally, the calyx glabrous or nearly so: lvs. glabrous or with few scattered hairs.*

21. *inodorus*, Linn. (*P. coronarius* var. *inodorus*, Martyn. *Deutzia corymbosa*, Hort.). Shrub, to about 1 ft., much resembling *P. coronarius* in general appearance: lvs. ovate to ovate-lanceolate, about 1–6 in. long, $\frac{1}{2}$ – $1\frac{1}{4}$ in. broad, entire or with very few, usually very small, distant teeth. May, June. N. C. and Tenn. to Ga. and Miss. B.M. 1478. Usually hardy N. Long in cult.; inferior to *P. coronarius*. Var. *grandiflorus*, Gray (*P. grandiflorus*, Willd. *P. latus*, Lindl., also of Lodd. *P. latus* var. *grandiflorus*, Loud.). Lvs. generally more elongate, more coarsely toothed, especially on young succulent shoots and suckers. N. C. to Ga. and Fla. (last according to Rydberg), naturalized at Bushkill, Pa.

22. *latus*, Schrad. (*P. grandiflorus* var. *latus*, Torr. & Gray. *P. speciosus*, Schrad. *P. pubescens*, Lodd.). Shrub, to scarcely more than $1\frac{1}{2}$ ft.: lvs. narrowly lanceolate, with rarely a few ovate-lanceolate, teeth small, evenly disposed, on young succulent shoots and suckers more or less ovate-lanceolate, more coarsely toothed, sometimes with tufts of hairs in axils of lateral veins: fls. white. April, May. Szechuan Province, China. B.R. 25:39.

BB. *Pedicels and calyx densely hairy to tomentose (sometimes glabrate); lvs. more or less densely hairy to tomentose beneath.*

c. *Fls. white or cream-colored.*

23. *hirsutus*, Nutt. (*P. hirsutus* var. *gracilis*, Schrad. *P. inodorus* var. *hirsutus*, Wood. *P. trinervius*, Schrad. *P. inodorus*, Schrad.). Upright or spreading shrub, to 8 ft.: lvs. lanceolate to ovate-lanceolate, 1–2¼ in. long, ¾–1½ in. wide, acuminate, regularly serrate (rarely denticulate), usually with more or less numerous short, rough hairs above, closely silvery-gray coated beneath, thin and papery when young. April–June. Rocky river banks, Tenn., N. C., Ga., Ala. Gn. 26, p. 375; 34, p. 138. B.R. 24:14. B.M. 5334.

24. *mexicanus*, Schlecht. (*P. guatemalensis*, and *P. sempervirens* applied to this in Calif. are apparently garden names). Evergreen shrub, to about 6½ ft.: lvs. ovate, 1½ in. long, ¾–1½ in. wide, acute to short-acuminate, distantly blunt-toothed, glabrous or spar-



2905. *Philadelphus Coulteri*. (× ½)

ingly hairy above, scabrous beneath with short stiff, closely appressed hairs, in general pointing toward the apex: fls. occasionally in short leafy racemes (a transition to the first great subdivision of the genus, see A in key on p. 2579), 2 in. across, cream-colored, fragrant. Mex. and, it is said, Guatemala. B.M. 7600. B.R. 28:37. R.H. 1852:381. G.C. II. 19:753; 34:218.

25. *microphyllus*, Gray. Erect, to 6 ft. (usually not so tall), or in its native habitat sometimes sprawling, with spreading slender or rigid branches: lvs. oblong-ovate, ¾–1 in. long, ¼–½ in. wide, acute or subacute (rarely obtuse), entire, scarcely if at all revolute more or less densely covered with silky hairs beneath, glabrous or with short hairs above: fls. ½–¾ in. across, white, exquisitely fragrant: caps. ¼–¾ in. long, ¼–½ in. wide, glabrous or slightly hairy. June, July. Utah and Colo. to Ariz., N. Mex., and Calif. G.C. III. 2:156; 11:86; 51:225. Gn. 40:288. P.G. 5:109.

cc. *Fls. with a purple spot at base.*

26. *Coulteri*, Wats. (*P. mexicanus* var. *Coulteri*, Burb.). Fig. 2905. Shrub, to about 10 ft.: lvs. ovate, 1½–2 in. long, ¾–¾ in. wide, obtusely to sharply pointed, on young succulent shoots and suckers, larger toothed, those of both young and old covered with rough hairs above and very white-tomentose beneath, the whole like a rough piece of felt: fls. white, very fragrant; petals with red spot at the base; calyx covered with silvery white silky hair: caps. unusually large, about ½ in. long. States of Nuevo Leon and Hidalgo, Mex. G.F. 1:233 (adapted in Fig. 2905). B.R. 14.—Very distinct, desirable for southern latitudes, and one of the most pleasing of the genus.

P. argenteus, Rydb. Low straggling shrub, with handsome silvery calyx, and lvs. silvery beneath. Fort Huachuca, Ariz. Rare plant for southern rockeries or borders. Because of rarity, only one plant, or preferably seeds, should be got, to prevent extermination.—*P. brachybotrys*, Koehne (*P. pekinensis* var. *brachybotrys*, Koehne). Of uncertain standing, allied to *P. coronarius*. The following variety is of greater merit. Var. *purpureascens*, Koehne. With purple calyx and pedicels. B.M. 8324 (as *P. Delavayi*).—*P. chinensis*—*P. coronarius* var. *acuminatus*.—*P. coronarius* var. *nikoensis*, A. H. Moore (*P. satsumanus* var. *nikoensis*, Rehd.). Related to var. *acuminatus*, differing in greater pubescence,

especially on the veins of lower lf.-surfaces.—*P. coronarius* var. *sempervirens*. Uncertain, probably—*P. coronarius* flore-pleno.—*P. coronarius* var. *tenuifolius*, Maxim. A variety differing but slightly from the type, of no advantage to horticulture.—*P. Delavayi*, L. Henry. Chinese, with fragrant fls., and generally more or less fringed petals, often marked with purple on the back. R.H. 1903, p. 13. Var. *melanocalyx*, Hort., is a variety with dark purple calyx.—*P. Dresden*. Hybrid of *P. Lemoinei* erectus and *P. pubescens*. Desirable.—*P. floridus*, Beadle. Desirable shrub, erect, to 6½ ft.: with attractive large, white fls., and calyx appressed silky. Suitable for S.E., and perhaps hardy N., like other southern species of this genus.—*P. Godoloheri*. Name said to stand for *P. hirsutus* and *P. laxus* in gardens.—*P. grandiflorus aureus*. Not possible to determine, because of confusion existing in regard to name *grandiflorus*.—*P. grandiflorus latus flore-pleno*. See note on preceding name.—*P. inodorus sanguineus*. Unknown. Name *P. inodorus* also variously applied.—*P. Lemoinei*. Of many varieties recently produced, but not yet intro. into American trade, the following seem worthy of mention. (See also derivatives of *P. phantasias*, originally treated as varieties of *P. Lemoinei*, under the former name.) *Albre.* Branches more graceful than in the variety *Virginal*: lvs. smaller: fls. full double as in that variety. *Banniere*. Branches arched with the weight of the fls., which are about 1½ in. across. *Dame Blanche*. Fls. creamy white, very fragrant; petals fringed. *Norma*. Profusely flowering: fls. large, white. *Ophelia*. Gracefully arching branches: fls. white, fragrant.—*P. magnificus*, Rehd. Garden hybrid of *P. inodorus* and *P. pubescens*.—*P. maximus*, Rehd. Garden hybrid of uncertain origin; resembling *P. coronarius* (perhaps hybrid of that with *P. pubescens*), but with the lvs. of young succulent shoots and suckers very large, hairy beneath. Not of horticultural merit.—*P. nepalensis variegatus*. Name of unknown application.—*P. phantasia*. The following varieties not yet in the American trade are of interest: *Oeil de Pourpre*. Fls. fragrant; petals with black-purple spot at base. *Romeo*. Profusely flowering: fls. creamy white, with a purple blotch. *Sirene*. Fls. large, fragrant, white, with a very slight suggestion of rose in the lower corners of the petals. *Surprise*. Fls. fragrant; petals spotted carmine-purple. *Sibylle*. Shrub with long curved branches, of pretty habit; fls. white, slightly fringed; petals pale pink spotted toward base.—*P. purpureascens*, Rehd.—*P. brachybotrys* var. *purpureascens*.—*P. Schrenkii*, Rupr. Closely related to *P. coronarius*. Upright: lvs. large and thin: fls. scentless, smaller; style appressed pubescent at base. Var. *Jackii*. Of uncertain hybrid parentage and doubtful merit.—*P. sempervirens*, Hort., offered in Calif., is *P. mexicanus*, described in No. 24; the name appears to have no botanical standing.—*P. serpyllifolius*, Gray. Closely related to *P. microphyllus*, than which it is more straggling, and less attractive, although perhaps good for rockeries. The only species with leathery revolute lvs.—*P. splendens*. Supposed garden hybrid, said to be worthy of cult.—*P. stenopetalus*, Carr. This is a species whose description in important particulars suggests *P. Falconeri*, for which it may prove to be an older name.—*P. tenuifolius*, Rupr.—*P. coronarius* var. *tenuifolius*, Maxim. Not of horticultural merit.—*P. umbellatus*, Koehne. Probably hybrid of *P. coronarius* and *P. inodorus*: fls. in broad 2–5-fld. panicles, compound of long-peduncled cymes. Parentage unknown.—*P. venustus*, Koehne. Closely related to *P. coronarius* var. *tomentosus*. Perhaps distinct.—*P. Wilsonii*, Koehne. New Chinese species of the group of *P. incanus*. Value unknown.

ALBERT HANFORD MOORE.

PHILAGÈRIA (a name composed from the parent genera). *Liliaceae*. A hybrid genus between *Philesia burzifolia* and *Lapageria rosea*. A smooth climbing shrub: sts. flexuous, rigid, cylindrical: lvs. alternate, petiolate, leathery, smooth, oblong-acute, 3-nerved: fls. pendulous; sepals glaucous, pale rose-purple; petals imbricate, scarcely open at the apex; anthers 6; ovary free, 1-celled.—One species, a greenhouse hybrid, *P. Veitchii*, Mast. G.C. 1872:358; III. 55:399. Apparently not in cult. at the present time. See *Lapageria*.

PHILESIA (Greek, lovely). *Liliaceae*. An interesting shrub of extra-tropical South America, little grown. See *Lapageria* and *Philageria*.

Species one, a woody plant bearing showy pendulous red *lapageria*-like fls. about 2 in. long. It is unlike the ordinary lily types with 6 similar perianth-segments, for it has distinct calyx and corolla parts of 3 sepals and 3 petals. It is closely allied to *Lapageria*, but differs in habit, in the calycine character of the outer perianth and the monadelphous stamens. It is said to live outdoors in the most favored localities of England and Ireland.

Philesia is too slow-growing ever to become very popular. It is a short-jointed hard-wooded shrub, with rather leathery box-like leaves, and will grow to about 4 feet in height in time. The writer's experience with this plant was in a camellia house, in which a night temperature of 45° was maintained, the plants being firmly potted in a light peaty soil. It flowered but

sparingly in the latter part of the summer. The flowers were borne only singly in the axils of the leaves. Cuttings may be rooted when taken from ripened growth, but require careful management in a cool temperature, and are usually several months in rooting. If one tries to grow philesia in a too high temperature, the general result is a good crop of thrips and a case of general debility, much as with *Pernettya mucronata* under similar conditions. Philesia is probably not extraordinarily hard to manage, provided it is kept cool and in a dewy atmosphere, but it will positively rebel against forcing. (W. H. Taplin.)

buxifolia, Lam. (*P. magellánica*, Gmel.). Much branched, 3–4 ft.: lvs. alternate, linear-oblong, 1–1½ in. long, leathery, evergreen, feather-veined, glabrous, glaucous beneath; margins reflexed; petiole jointed at the junction of the blade: fls. solitary, bright rosy red; petals wavy; filaments united into a tube below the middle, then free; ovary 1-celled, with 3 short parietal placentae which bear several ovules: fr. a berry. S. Chile to Magellan. B.M. 4738. F. 1854:65. G.C. II. 18:105; III. 55, suppl. June 6. J.H. III. 42:299. G. 36:329. H.F. 4:72.

WILHELM MILLER.

PHILIBERTÉLLA: *Philibertia*.

PHILIBÉRTIA (after G. C. Philibert). Incl. *Sarcostemma* and *Philibertia*. *Asclepiadaceae*. Climbing shrubs or half-shrubs, white-pubescent or glabrous, sometimes grown under glass or far S. for ornament: lvs. opposite: infl. umbelliform cymes, pedunculate in one axil or rarely sessile; fls. variable in size, often greenish white; calyx small, 5-parted, minutely glandulose within, lobes acute; corolla very broadly campanulate or subrotate, divided slightly to the middle or deeply 5-cleft, with the lobes twisted and narrowly overlapping to the right; exterior crown membranaceous, ring-like, adnate to the base of the corolla, free from the stamen-tube or more or less connate with the median wings of the opposite anther, interior 5 crown-scales adnate with the base of staminal tube, with a variable lamina; stamens affixed to the base of the corolla, the filaments forming a short tube: fr. smooth, acuminate, somewhat thickened follicles.—About 30 species, Trop. and Subtrop. Amer. *P. clausa*, Schumann (*Philibertia clausa*, Vail). Sts. glabrous or minutely pubescent at the nodes: lvs. ovate-oblong or lanceolate-oblong, apex acute or acuminate, base rounded or subcordate, peduncles twice as long as the lvs., or more: fls. many; calyx-lobes oblong lanceolate, acute, pubescent; corolla white, lobes oblong, fimbriate-ciliate. Fla.—A twining perennial with glossy evergreen lvs. and very sweet-scented fls., which has been offered in the trade-lists. *P. gracilis*, D. Don (*P. grandiflora*, Hook.). Twining shrub: lvs. opposite, cordate at base: the umbels borne between the petioles; calyx 5 deep acuminate segms.; corolla rotate-campanulate, more than 1 in. diam., with 5 triangular segms. and a small tooth between them, cream-colored dotted and streaked with purple inside. S. Amer. B.M. 3618. H.U. 2, p. 261. Cult. to some extent in Eu.

F. TRACY HUBBARD.

PHILLYREA (its ancient Greek name). *Oleaceae*. Ornamental woody plants, grown for their handsome evergreen foliage.

Evergreen shrubs or small trees: lvs. opposite, short-petioled, entire or serrate, quite glabrous: fls. small, in axillary short racemes, dioecious; calyx 4-toothed; corolla 4-lobed, with short tube; stamens 2, with very short filaments; style shorter than tube; ovary 2-celled: fr. a 1-seeded black drupe.—Five species in the Medit. region. The name is sometimes misspelled *Filaria*.

The phillyreas have small, or in one species rather large leaves, and small white flowers, followed by small

berry-like purplish black fruits. The species are hardy only South, but *P. decora*, the handsomest of all the species, is probably hardy in sheltered positions as far north as Massachusetts. They may be used in the southern states and California for evergreen shrubberies in drier and more exposed localities. They grow in almost any soil and prefer sunny positions; but *P. decora* seems to grow better if partly shaded. Propagation is by seeds sown after maturity and by cuttings of half-ripened wood under glass in summer or by layers; they are also sometimes grafted on *Ligustrum ovalifolium*.

A. Lvs. ¾–2 in. long: fr. small.

B. Shape of lvs. roundish oval to oblong-lanceolate, usually serrate.

latifolia, Linn. Shrub or small tree, to 30 ft., with spreading, somewhat rigid branches: lvs. ovate or oval to ovate-oblong, rounded or slightly cordate at the base, usually serrate, dark green and shining above, pale beneath, ¾–1½ in. long: fr. globose, concave at the apex. May, June. S. Eu., N. Afr. H.W. 3, p. 123. R.F.G. 17:1075. There are several varieties. Var. **laevis**, Ait. Lvs. ovate, almost entire or slightly serrulate. Var. **rotundifolia**, Arb. Kew. Lvs. broadly ovate or roundish ovate. Var. **spinosa**, Ait. (*P. ilicifolia*, Willd.). Lvs. ovate or ovate-oblong, sharply serrate.

media, Linn. (*P. latifolia* var. **media**, Schneid.). Spreading shrub, to 20 ft.: young branchlets puberulous: lvs. oblong-ovate to ovate-lanceolate, entire or serrate, dark green and shining above, ¾–2 in. long: fr. ovoid, pointed. May, June. Medit. region. N.D. 2:27. G.O.H. 116. R.F.G. 17:1075.—This species seems to be somewhat harder than the preceding and the following; the most important of the many varieties are the following: Var. **buxifolia**, Ait., with oblong-ovate, obtusish lvs. Var. **oleaefolia**, Ait. (*P. oleaefolia*, Hort.). Lvs. oblong-lanceolate, almost entire: branches erect. Var. **pendula**, Ait. Branches spreading and somewhat pendulous: lvs. lanceolate.

BB. Shape of lvs. lanceolate to linear-lanceolate.

angustifolia, Linn. Spreading shrub, to 15 ft., with glabrous branchlets: lvs. oblong-lanceolate to linear-lanceolate, usually entire, dull green above, 1–2 in. long: fr. globose or ovoid-globose, pointed. May, June. Medit. region. G.O.H. 115. R.F.G. 17:1076. Var. **lanceolata**, Ait. Lvs. lanceolate, about 1 in. long. Var. **rosmarinifolia**, Ait., has linear-lanceolate lvs., sometimes over 2 in. long, and erect branches. The 3 preceding species are very closely related to each other and considered by some botanists to be varieties of only 1 species and designated as *P. variabilis*, Timbal & Loret, or *P. vulgaris*, Caruel.

AA. Lvs. 3–5 in. long: fr. ½ in. long.

decora, Boiss. & Bal. (*P. Vilmoriniana*, Boiss. & Bal. *P. laurifolia*, Hort. *P. Medwediewi*, Sred.). Shrub, to 10 ft., with spreading branches: lvs. oblong to oblong-lanceolate, acuminate, usually entire or remotely serrulate, dark green and shining above, yellowish green beneath: fr. oblong-ovoid, purplish black. June, July. W. Asia. B.M. 6800. G.C. III. 4:673; 16:369. R.H. 1889, p. 199; 1895, pp. 204, 205. M.D.G. 1898:349. S.H. 2:523. Gn. 24, p. 490. G. 30:325; 36:657. G.W. 5:259.

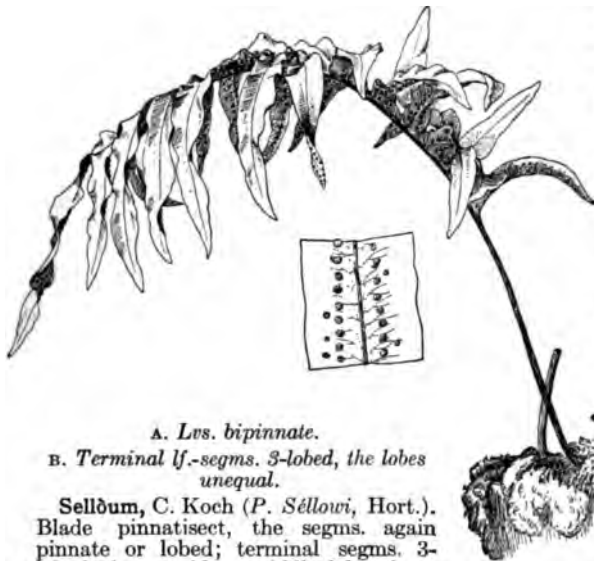
ALFRED REHDER.

PHILODÉNDRON (Greek compound for *tree-loving*). *Araceae*. Shrubby or tree-like ornamental plants, usually climbing, rarely arboreous.

Internodes more or less elongated: lvs. from entire to bipinnatifid: fls. monocious, on spadices, with no perianth, the sterile with 2–6 stamens united into a sessile obpyramidal body, the pistillate fls. with a 2–10-lobed ovary and some staminodia, the berries inclosed in the involute spathe.—The species are all Trop.

American. They are monographed by Engler in *Das Pflanzenreich*, hft. 60 (IV. 23 Dd) 1913, who accepts 222 species. Some of them are prominent in tropical plantings.

Only a few philodendrons can be grown to have an ornamental appearance in a small state. One which goes under the name of *P. elegantissimum*, with finely cut leaves, makes a good pot specimen, although it will reach considerable height when suitable opportunities are afforded. The same may be said of *P. Sellowii*, a beautiful species with pinnatifid leaves. The arborescent kinds should have a very porous rooting medium and copious supplies of water while in active growth. When climbing, they must have provision made for the roots, which are produced along the stems. Some of the species do well climbing up the stems of tall palms, such as arenga and livistona; otherwise dead trunks of tree ferns make admirable rooting substances for the roots to penetrate and cling to. Propagation is by division of the climbing stems. *P. elegantissimum* is an unidentified trade name.



A. Lvs. bipinnate.

B. Terminal lf.-segms. 3-lobed, the lobes unequal.

Sellowii, C. Koch (*P. Sellowii*, Hort.). Blade pinnatisect, the segms. again pinnate or lobed; terminal segms. 3-lobed, the cuspidate middle lobe about equaling the obtuse lateral ones: spathe slightly cuspidate, its tube longer than the ovate hooded blade, green without, white within. Distinguished from *P. bipinnatifidum* by the very numerous parallel translucent spots, which are visible on both sides of the lf. and are often excurrent on the margin. Brazil to Paraguay. B.M. 6773. G.W. 10, p. 211.

BB. Terminal lf.-segms. 3-5-lobed, the middle lobe much longer than the lateral ones.

bipinnatifidum, Schott. Blade pinnatisect, the segms. again pinnate or lobed; terminal segm. 3-5-lobed, the middle lobe ovate-lanceolate, acute, much longer than the obtuse lateral ones: spathe oblong-ovate, its tube scarcely distinct from its blade, purple without, white within. S. Brazil.—Does well in the open in S. Calif.

AA. Lvs. simple.

B. Lf.-blade linear or lanceolate.

crassinervium, Lindl. Climbing: lvs. linear to lanceolate-acuminate, the midnerve very thick and inflated: spathe obtuse and hooded, apiculate at the tip. Brazil. B.R. 1958.—*P. nobile*, Bull. is like this but larger: lvs. long-oblancoate, large, coriaceous, and shining, obtuse or short-acuminate, narrowed at base: tube of spathe rosy crimson inside and outside, the limb white inside and spotted outside. Guiana.

BB. Lf.-blade sagittate.

speciosum, Schott. St. tall, arborescent: petioles terete at the base, concavo-convex above, twice as long as the midrib; blade triangular-oblong-ovate, bright green, acuminate, deeply sagittate, the basal lobes rhomboidal, obtuse, abruptly narrowed on the inner side above the middle: spathes thick, green with purple margins; spadix finger-shaped, shorter than the spathe. S. Brazil.

BBB. Lf.-blade oblong to ovate-cordate.

c. Color of lvs. milky white above, with reddish veins.

Sodiroidi, Hort. Lvs. cordate, ovate, milky white with reddish veins above; petiole cylindrical, pink. *P. Sodiroidum*, Engler, is a different plant, apparently not in cult.

cc. Color of lvs. some shade of green above.

d. Petioles tomentose.

verrucosum, Mathieu (*P. Cárderi*, Hort. *P. Lindenii*, Hort.). St. long, branching, climbing, ashy gray, scabrous, angular-cylindrical, swollen at the nodes; internodes 3-6 in. long: petioles stout-cylindrical or somewhat angled, bright metallic red, covered with soft, erect, twisted, fleshy bristles and greenish hairs 4-6 in. long; blade glabrous, green above, brilliantly polished, or with paler lines and immersed nerves, bright green beneath with salmon-violet lines between the lateral nerves, 6-8 in. long, 4-6 in. wide, ovate-cordate, the semicircular basal lobes one-third as long as the slightly undulate apical one. Costa Rica southward. I.H. 18:79 (as *P. douglense*).

DD. Petioles glabrous.

giganteum, Schott. Climbing: petioles 3 ft. long, thick, cylindrical; blade cordate-ovate, 24-28 in. long, 16-20 in. wide, the basal lobes slightly introrse, semi-ovate or obliquely semicircular, one-fourth as long as the apical one, separated by a broad parabolic sinus: spathe-tube 2 in. long, oblong, purple; spadix very thick. Trop. Amer.

Imbe, Schott (*P. Sellowianum*, Kunth). Branches rusty purple: petioles of young plant semi-cylindrical, terete, sparsely brown-spotted, 1½-2 times longer than the midrib; blade like parchment, cordate-oblong, the oblong basal lobes one-half as long as the apical, separated by a wide parabolic sinus, retrorse or subintrorse; apical lobe cuspidate: spathe green outside, red within, its broadly ovate blade dirty yellow; spadix shaped like a finger. S. Brazil. The Mexican *P. sanguineum* has been called *P. Imbe* in gardens. *P. sanguineum* differs in having more elongated lvs. which are red beneath.

spectabile, Lind. Large, of vigorous habit: lvs. 12-15 in. long, nearly as broad, silky or velvety green.

Andreanum, Devans. Lvs. rather large, cordate-ovate, with short basal lobes, bronzy green. Colombia. R.H. 1886:36. R.B. 13, fig. 30.—Sparingly grown. Looks like a narrow-lyd. anthurium.

P. calophyllum, Brongn. (*P. nobile*, Bull. in part). Lvs. tufted, 2-3 ft. long, 5-6 in. broad at middle, linear-oblong, acuminate, shining above, the costa very thick at base, with linear depressions: spathe pale yellowish green outside, inside bright carmine with white margin. N. Brazil. B.M. 7827.—*P. canini*, thick, coriaceous, oblong, shining above, the spathe cymbiform, green outside, purple, green inside. Brazil.—*P. Corsonianum*, Makoy. Lvs. 1½-2 in. broad, shortly pinnatifid, deep green above with green veins: spathe with a purple-crimson limb light green with red spots outside, the darker spots. Hybrid. B.M. 8172.—*P. Devansia*, scandent species with rather small glossy green the petioles, are blood-red when young. *P. Durini*, Hort. Lvs. broadly and deeply *erubescens*, C. Koch. Climbing: lvs. elongated ovate, 4-6 in. long, 4-6 in. wide: spathe black-purple.—*P. G.* is a climber something like *P. crassinervium*: lvs. deep green, 12-18 in. long, 3-5 in. broad: spat:

crimson within the tube. Brazil. B.M. 6813.—*P. flemanii*, Hort. Lvs. oblong, cordate, dark green, splashed or marbled with white, and sometimes tinged rose-pink. G.C. III. 43:289.—*P. imperiale* is mentioned in European trade-lists. Engler accounts for only one *P. imperiale* (of Schott) and that he makes a synonym of *P. asperatum*, Koch. Sander & Co. advertise *P. imperiale* var. *Lauchiana*: "a lovely trailing stove foliage plant, which is admirably adapted for growing on pillars or wire shapes. It is quite distinct from and greatly superior to the well-known *P. imperiale*. The habit is much more graceful, the heart-shaped foliage smaller and more elegant. Down the center, from either side of the broad light green midrib, extend irregular blotches of dark green, projecting into a clear glaucous color, the edges of which are relieved by green blotches. The bases of the petioles bear bright red and green phylodes." *P. asperatum* is a short-jointed climbing Brazilian species with cordate-ovate entire dull green lvs.—*P. Mamei*, André. Lvs. cordate-ovate, acute, variegated with white: spathe partly open above and whitish, the tube blood-red. Ecuador. R.H. 1883, p. 104 and 492; 1897, p. 573. I.H. 43:66.—*P. pertusum* is *Monstera deliciosa*.—*P. Simsii*, Kunth. Lvs. coriaceous, elongated triangular-sagittate, long-cuspidate, up to 20 in. long: spathe outside black-purple on the tube, yellowish on the limb. Guiana. B.M. 2643.—*P. bipartitum*, Schott. (Anthurium insignis, Mast.). Lvs. 3-parted, 6-7 in. long: spathe-tube oblong, the blade whitish, ovate, shortly acuminate. Venezuela.—*P. Warszewiczii*, C. Koch. Lvs. triangular-sagittate, bipinnatifid, primrose, the lateral primary segms. 5-8 in. long. Cent. Amer. G.W. 10, p. 211. Gt. 59, p. 23.

GEORGE V. NASH.†

PHLEBODIUM (Greek, *a vein*). *Polypodiaceae*. A genus of ferns related to *Polypodium* and sometimes united with it, but differing widely in the venation, which is broken up into ample areoles, each of which contain 2 or more free veinlets which bear the sori on their united tips.

aureum, R. Br. (*Polypodium aureum*, Linn.). Fig. 2906. Rootstocks thick, creeping on surface, densely covered with bright yellowish scales: lvs. 2-4 ft. long, deeply pinnatifid, the lobes 5-9 in. long, $\frac{1}{2}$ -1 in. wide, with numerous bright yellow sori. G. 37:405.—A rich ornamental species of easy cult. from Trop. Amer. with glaucous green lvs. It produces, however, but a small number of lvs. to a plant. In Fla. it grows on palmettos. *Polypodium Mandaianum* of the trade is a wavy-lyd. form, which originated as a spore sport of the species, *P. aureum*. It develops lvs. of great beauty, which last for a long time on or off the plant. Cut off, they are used for florists' decorations. *Polypodium Schneideri*, Hort., is said to be a hybrid of *P. aureum* and *Polypodium vulgare*.

P. glaucum var. *Mayii* or *P. Mayii*. See Phymatodes.

L. M. UNDERWOOD.
R. C. BENEDICT.†

PHLEUM (*Phleos*, an old Greek name for a kind of reed). *Gramineae*. Perennial grasses, of great agricultural value, but scarcely horticultural subjects.

Spikelets 1-flid., in a close cylindrical spike-like panicle; glumes 2, persistent, keeled, short-awned; lemma shorter, delicate, awnless.—Species 10, in temperate zones.



2907. *Phleum pratense*.—Timothy.
To show habit of root and top.

pratense, Linn. TIMOTHY. HERD'S-GRASS. Figs. 2907, 2908. Commonly cult. for hay and for pastures, either alone or together with red clover or other grasses. It was intro. into Md. about 1720 from Eu., where it is native, by Timothy Hanson, and hence called timothy. The other name is said to come from a man by the name of Herd, who found it growing in N. H. and began its cult. It is better adapted for hay than for pasture, and for the latter is suited to temporary rather than permanent pasture.

A. S. HITCHCOCK.

PHLOGACANTHUS (Greek for *flame*, and *acanthus*). *Acanthaceae*. Glasshouse plants grown for the ornamental flowers.

Tall half-shrubby herbs with entire or somewhat toothed lvs.: fls. white, red or greenish in long terminal or short lateral spikes; calyx 5-parted; segms. linear, awnlike, acuminate; corolla-tube long, broad, curved; limb 2-lipped, upper lip erect, entire or 2-lobed; lower lip 3-parted; perfect stamens 2, inserted on the lower part of the tube; anthers with 2 parallel cells; ovary many-ovuled: caps. round or obtusely 4-angled.—Species 12-15, India, Malaya, to New Guinea. Several of the species have been more or less cult. at one time or another. Used like the others of the family as decorative pot-plants in the greenhouse. They require a rather warm, damp atmosphere and a soil rich in humus. Prop. by cuttings or seeds.

thyrsiflorus, Nees (*Justicia thyrsiflora*, Roxbg.). Shrub, 3-7 ft. high: lvs. 7 x $1\frac{1}{4}$ in., lanceolate, glabrous: fls. orange, in long, dense, villous thyrses; corolla $\frac{3}{4}$ in. wide, tubular, 2-lipped. India.—Cult. in S. Fla.

P. curvislorus, Nees. Shrub, 3-6 ft. high: lvs. large, elliptic, acute at both ends, toothed, glabrous: fls. yellowish, with an elongated corolla. Himalayas. B.M. 3783. H.U. 2, p. 259. HEINRICH HASSELBRING.

PHLOMIS (old Greek name used by Dioscorides). *Labiatae*. JERUSALEM SAGE. Stout mostly tall plants sometimes grown in the open for the dense axillary whorls of rather large yellow, purple or white flowers.

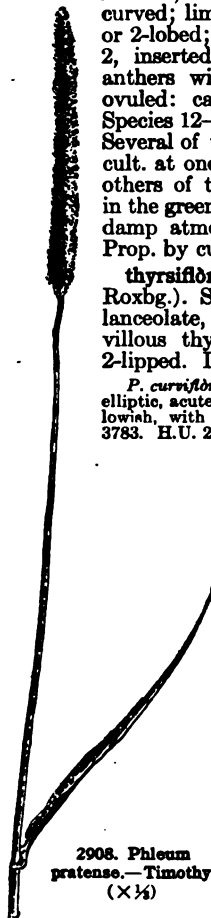
Plants more or less woolly, some of the species conspicuously white-woolly, shrubs or perennial herbs: lvs. all alike, or the uppermost reduced to bracts: whorls many- or few-flid.; fls. sessile; calyx usually plicate, truncate or with 5 equal teeth; upper lip of the corolla (galea) broad and compressed or strongly concave, rarely narrow and falcate; lower lip 3-cleft and spreading; tube usually bearing a woolly ring inside; stamens 4, didynamous, ascending under the upper lip, one pair of filaments

often appendaged at base; style 2-lobed: nutlets 4, obovoid or ovoid, triquetrous, glabrous or pubescent.—Medit. region and to China, perhaps 70 species. Perhaps a dozen species have been cult., but they are rather coarse plants except for wild gardening and among shrubbery. They are of the easiest cult. Prop. by seeds, cuttings, and the herbaceous species by division. *P. tuberosa*, Linn., of Eu., has run wild sparingly in the E. It is a vigorous and hardy species, prop. by subterranean tubers.

A. Fls. yellow.

fruticosa, Linn. JERUSALEM SAGE. Shrub, 2-4 ft. high, divaricately much-branched, yellowish tomentose: lvs. ovate to oblong, rounded or wedge-shaped at the base, rugose, green above and white-tomentose beneath: whorls 20-30-flid., one or two at ends of branches; bracts broadly ovate or ovate-lanceolate: fls. yellow, showy. S. Eu. B.M. 1843. Gn. 79, p. 114. G. 7:177; 35:713.—In the E. it blooms from June to July. In S. Calif., it blooms in winter, and has the merit of withstanding drought and heavy sea winds. In New England it needs protection in winter.

lunarifolia, Sibth. & Smith. Undershrub, erect and branching, green but oppressed-tomentose, 6 ft.: lvs.



2908. *Phleum pratense*.—Timothy.
($\times \frac{1}{4}$)

oblong or ovate-oblong, obtuse at apex, narrowed at base, paler and almost hoary beneath, the lower ones long-stalked: fls. golden yellow, $1\frac{1}{2}$ in. long, in a showy terminal whorl or head 4 in. across with 2 pendulous floral lvs. beneath; bracts small, or orbicular; calyx $\frac{3}{4}$ in. long, 10-ribbed; corolla with villous 2-keeled galea, and large lower lip with 2 wings or lobes at end. Asia Minor. B.M. 7699.—A striking plant.

Lychnitis, Linn. LAMP-WICK PLANT. Somewhat woody, 2 ft., hoary: lvs. sessile and amplexicaul, oblong-linear, narrowed at both ends, white-tomentose beneath: whorls few-fld., much shorter than the floral lvs.; bracts broad at base; fls. yellow, the corolla twice longer than calyx. S. Eu. B.M. 999.—The specific name *Lychnitis* refers to the use of the slender radical lvs. as lamp-wicks.

viscosa, Poir. (*P. Russeliæna*, Benth.). Shrubby, glabrous, but viscid above, with elongated branches: lvs. ovate and oblong-lanceolate, the lower ones petioled and strongly cordate at base; floral lvs. cuneate-lanceolate and acuminate, much surpassing the fls.: whorls many-fld., remote, with lance-linear rigid bracts; corolla yellow, twice longer than calyx, the galea emarginate, lower lip with broad lobe. Asia Minor. B.M. 2542 (as *P. lunarifolia* var. *Russeliæna*).

AA. Fls. purple, or pinkish, at least inside.

tuberosa, Linn. Herb. 3-6 ft. high, nearly smooth, with thickened root: lvs. deeply cordate, ovate, petioled, crenate, the lower ones triangular-ovate and 6 in. or more long; floral lvs. 2-3 in. long, 6-8 lines wide, oblong-lanceolate: whorls 30-40-fld., bearing purple fls. that are white-bearded inside. S. Eu., E. and N. Asia. B.M. 1555.—Little planted; known mostly as a weedy naturalized species.

Herba-venti, Linn. Much-branched, 1-2 ft., hairy: lvs. oblong-lanceolate, or ovate-oblong, crenate, coriaceous, rounded at base, either canescent or green beneath: whorls 10-20-fld., much surpassed by the long floral lvs.; fls. purplish, tomentose on outside; galea much arched; lower lip short. Medit. B.M. 2449. G. 35:712.—The name *Herba-venti* means "wind herb." It is recorded that "when exposed to wind and rain, the leaves are apt to lose their softer parts, leaving merely a network of fibers, pervious to the wind, whence the old name of *Herba-venti*."

cashmeriæna, Royle. Sts. several, stout, terete, densely white-woolly, 2-3 ft. high: lvs. linear-oblong, obtuse, rugose and crenate, cordate at base, pubescent above, the radical ones long-petioled: whorls many-fld., $1-1\frac{1}{2}$ in. diam.; bracts numerous, filiform, ciliate and tomentose; fls. pale purple; galea very large, tomentose but not fringed; lower lip very broad; calyx-teeth spine-like and half length of the tube. Afghanistan, Himalaya. B.R. 30:22. J.F. 3:284.

Sâmia, Linn. Pubescent, 2-3 ft., simple or sparingly opposite-paniculate-branched: lvs. ovate-oblong, cordate and somewhat acute, petioled, rugose and crenate, green above and tomentose beneath: whorls 10-15-fld., bracts many, linear, very acute; fls. hairy, greenish white outside, pinkish and purple-veined inside. Greece, Asia Minor. B.M. 1891. G. 35:711. L. H. B.†

PHLOX (Greek for *flame*, once applied to species of *Lychnis*). *Polemoniaceæ*. Showy and popular flower-garden herbs, perennial and annual.

Erect or diffuse, tall or low, mostly perennial, glabrous, pubescent or hairy, a few of them woody at base but mainly herbaceous throughout: lvs. mostly opposite or sometimes the upper ones alternate, entire: fls. in bright colors, blue, red, blue-red, purple, white, in terminal cymes or thyrses; calyx narrow-tubular or sometimes nearly campanulate, 5-ribbed and 5-cleft, the lobes sharp-pointed; corolla convolute in bud, salverform, with a very slender tube and a flat-spreading 5-lobed limb, the lobes obovate or broader and some-

times notched; stamens 5, usually unequal in length or in point of attachment, usually included; ovary 3-celled, oblong or ovoid, the style slender: caps. 3-valved, the seeds 1 or few in each cell, usually 1.—Species 48 as defined by Brand in Engler's *Das Pflanzenreich*, hft. 27 (IV. 250), 1907, one of which is Siberian and the

others N. American, in woods and thickets and on prairies and plains, some of them alpine and arctic.

From a horticultural point of view, the phloxes may be thrown into five groups: (1) the annual phloxes, *P. Drummondii*; (2) the highly developed summer

perennial tall phloxes of nurseries and gardens, *P. paniculata* and *P. maculata*; (3) the moss pinks, *P. subulata* and its variants, useful as carpeters; (4) those useful in alpine and rock-gardening, although little employed for the purpose in America, represented by *P. multiflora* and the caespitose Rocky Mountains set which seems not to be in the lists; (5) the early blooming perennial woods and plains species not yet much domesticated but often naturalized in grounds, as *P. pilosa*, *P. divaricata*, and others. As a group, phloxes are amongst the most satisfactory of garden plants.

Their neat habit, bright-colored flowers, profuseness of bloom, and ease of culture make them favorites everywhere. Most of the domesticated kinds are summer bloomers, but *P. subulata* is spring-flowering.

The annual phloxes, derivatives of *Phlox Drummondii*, of Texas, have risen to first place as garden annuals. This species has been much modified by domestication, so that the named garden varieties are numbered by dozens. These garden forms differ in stature, color, size and shape of flower. Some are semi-double. An effort has been made to produce a yellow flower, but apparently a true yellow has not yet been secured. The colors run to the cyanic series, in many interesting variations. *Phlox Drummondii* is of the easiest culture. This fact, together with the profusion and long season of its bloom, is an important reason for its popularity. It blooms all summer and until frost if the stock and conditions are good. It needs a warm sunny place. It will grow even in poor soil, but in order to develop to its highest perfection it must have good soil and the individual plants must be given room (say 1 foot apart each way). Seeds are usually sown in the open as soon as the weather is settled; sometimes they are sown indoors, but the plants bloom so young that this is rarely practised. If the ground is poor and dry, the plants usually cease blooming by midsummer, but if plant-food and moisture are abundant they may be expected to continue their bloom until late autumn. To attain this result most perfectly, the old flower-



2909. Cultivated forms of
Phlox Drummondii.

cluster should be removed; the plant is an end-bloomer, and when the terminal flower-cluster has matured the other shoots continue the growth and thereby provide a succession of bloom. This phlox has now varied so much under domestication that packets of mixed seed are likely to give tall and dwarf, large-flowered and small-flowered forms, with very unsatisfactory results. If mixed colors are desired, pains should be taken to secure seed that will produce plants of similar height and season. Some of the cheap seed may produce very disappointing plants even under the best conditions.

The summer perennial phloxes of gardens are of several races. They are probably the issue of *P. paniculata* and *P. maculata*, although their origin and characteristics need to be worked over. This group of plants is amongst the most showy of garden herbs. The terminal panicles have become 1 foot long in some forms, and as densely filled as a hydrangea. They are especially desirable when color display is sought in connection with formal or semi-formal designs, as on terraces and by balustrades. The colors are most frequent in reds, but there are many purple, white, salmon, and parti-colored varieties. The summer perennial phlox should have a rich and rather moist soil if it is to be grown to perfection. It should never suffer for moisture or food. Let each clump have a space, when fully developed, of 2 to 3 feet across. The plants as purchased from nurseries usually do not come into full floriferousness until their third year. For the highest satisfaction in blooms, the plants should be relatively young or at least often renewed by dividing the clump. The stool gradually enlarges outward. From the young vigorous shoots on the outside of the clump the new plants should be reared, if one desires to propagate the variety to any extent. Old stools should be taken up every year or two, and divided and transplanted. This work is performed in the fall, after the growth has ceased. By this process, the plants do not become weak and root-bound. Inferior and vigorous seedlings are often allowed to grow about the old plant, causing the named varieties to "run out." The modern varieties should not remain undisturbed for more than three or four years. One of the requisites is to secure in the first place stock that is strong and healthy. Phloxes usually bloom in early summer and midsummer, but if the tips of the shoots are pinched out once or twice in early summer, the bloom may be delayed until late summer or autumn. Named varieties are propagated by side shoots and by cuttings of well-maturing shoots. Seeds give new and often interesting forms.

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| <i>frondosa</i> , 12. | <i>pyramidalis</i> , 3, 3a. | |

A. Species annual, pubescent: upper lvs. often alternate.

1. *Drummondii*, Hook. Figs. 2909, 2910. Erect branching annual, more or less villous and viscid, 6-18 in. tall: lvs. alternate, oblong-acute or lanceolate, the upper ones more or less clasping: fls. showy, in broad mostly flat-topped cymes, the calyx-lobes long and narrow and spreading or recurving in fr., the corolla-lobes broad-ovate. Sandy soils. Texas. B.M. 3441. B.R. 1949.—This is the original of the common annual garden phlox, now cult. in numerous varieties. The seeds were received in England in the spring of 1835, from Texas, having been collected by Drummond. In Oct. of that year it was described and figured in B.M., by W. J. Hooker, as *Phlox Drummondii*. The fl. was described as "pale purple without, within, or on the upper side, of a brilliant rose-red or purple, varying exceedingly on different individuals in intensity, and in their more or less red or purple tinge: the eye generally of an exceedingly deep crimson." Lindley described and figured it in B.R., for 1837, describing the fls. as "either light, or deep carmine, on the inner surface of their corolla, and a pale blush on the outside, which sets off wonderfully the general effect. A bed of this plant has hardly yet been seen; for it is far too precious and uncommon to be possessed by any one, except in small quantities; but I have had such a bed described to me, and I can readily believe that it produced all the brilliancy that my informant represented."

The annual garden phloxes are now of many kinds and races. They may be thrown into two groups: Var. *rotundata*, Voss, with petals large, broad, and entire or nearly so, making a circular outline; var. *stellaria*, Voss, the star phloxes, the petals narrow, cuspidate or variously fringed or cut. To the former belong such races or forms as *Heynholdii*, *Deppei*, *Isabellina*, *formosa*, *splendens*, *hortensisflora* or *verbenziflora*, *grandiflora*. With the latter (var. *stellaria*) may be classed *cuspidata*, *fimbriata* or *laciniata*, *stellata*. There are also dwarf and intermediate races of annual phloxes as well as semi-double forms. For a discussion of the heredity of color in *Phlox Drummondii*, see Gilbert, Journ. Agr. Research, July, 1915.

There are several annual phloxes in Texas, some of them perhaps to be regarded as variants of *P. Drummondii*. *P. villosissima*, Small (*P. Drummondii* var. *villosissima*, Gray), is very villous and viscous, the fls. large and more scattered, the lvs. mostly opposite and the blade thick and bristly: corolla pale lavender, the



2910. Quedlinburg or star phlox. A horticultural form of *Phlox Drummondii*. (Natural size)

limb $\frac{1}{2}$ –1 in. broad, lobes broad-obovate and often abruptly pointed. *P. tenuis*, A. Nelson (var. *tenuis*, Gray) is small and slender, not villous, glabrous or slightly pubescent: lvs. mostly alternate, the blades thin and linear or linear-lanceolate: fls. lavender, small, the limb about $\frac{1}{2}$ in. across, lobes rhombic-ovate and acute. *P. aspera*, A. Nelson. With short rigid hairs: lvs. opposite, the blades thick, narrow-lanceolate to linear: calyx and pedicels glandular, the calyx-lobes awned; corolla violet, the tube glandular-pubescent; lobes cuneate-obovate, about $\frac{1}{2}$ in. long, mucronate. *P. Roemeriana*, Scheele. Glabrate or somewhat hirsute: lvs. mostly alternate, spatulate-oblong or lanceolate, sessile, usually acute or acuminate: fls. solitary or few, pink or rose-colored; corolla-tube not surpassing the calyx (in this differing from the other annual Texan phloxes); limb of corolla less than 1 in. across, the lobes roundish obovate and entire; ovules 4 or 5 in each cell.

AA. *Species perennial, of various habit, either pubescent or glabrous.*

B. *Flowering st. erect and usually stiffish (Nos. 2–9).*

C. *Plant mostly glabrous, at least below (exceptions in variety of No. 5).*

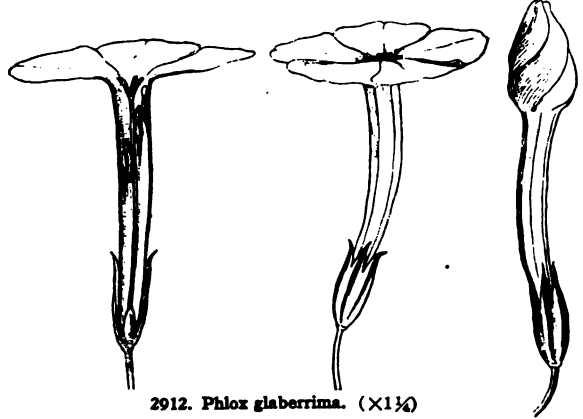
D. *Infl. large and thyrselike: plants tall.*

2. *paniculata*, Linn. (*P. decussata*, Hort. *P. acuminata*, Pursh. *P. cordata*, Ell. *P. undulata*, Ait.). SUMMER PERENNIAL PHLOX of gardens, in many forms. Fig. 2911. Plant stout and erect, 2–4 or 6 ft., glabrous: lvs. thin, oblong-lanceolate and mostly tapering at the base, acute or acuminate: calyx-teeth awl-like. Woods, Pa.,



2911. Summer perennial phlox, of the *P. paniculata* and *P. maculata* group.

west and south. Summer. B.M. 1880.—The parent of the greater number of perennial phloxes of gardens, although some of these may be hybrids with the next. "Fls. pink-purple, varying to white," according to Gray. In cult. varying much in color. This plant, in several



2912. *Phlox glaberrima*. ($\times 1\frac{1}{2}$)

forms, persists about old homesteads and sometimes becomes naturalized. *P. amplifolia*, Brit., with st. villous, glandular above, lvs. broader, ranging from Ind. to Tenn. and Mo., is considered by some to be a form of *P. paniculata*.

3. *maculata*, Linn. (*P. pyramidalis*, Smith. *P. reflexa* and *P. penduliflora*, Sweet). SUMMER PERENNIAL PHLOX. Slenderer, and mostly less tall, usually with purple-spotted st.: lvs. very smooth and usually thicker than those of the above, the upper ones usually clasping: calyx-teeth short: fls. as in above. Range of the last, and in cult., but less important horticulturally than *P. paniculata*. Summer. Var. *suaveolens*, Brand (var. *candida*, Michx. *P. suaveolens*, Ait. *P. lardiflora*, Penny. *P. longiflora*, Sweet. *P. alba*, Moench). St. glabrous, not spotted: fls. sweet-scented, white.

The foregoing treatment of the synonymy of the two species entering into the origin of the summer perennial phloxes is essentially that of Gray. Brand removes a number of these names into a separate category comprising a range of hybrids, and accounts for other old horticultural names, as follows:

3a. *paniculata* \times *maculata*, Brand. *P. pyramidalis*, Smith; *P. decussata*, Lyon; *P. reflexa*, *P. excelsa*, *P. Wheeleriana*, *P. Shepherdii*, *P. penduliflora*, Sweet; *P. missouriensis*, Salm-Dyck; *P. omniflora*, *P. atrocaulis*, *P. Ingramiana*, *P. pulchella*, *P. Vernoniiana*, Hort.; *P. Youngii*, *P. Coldryana*, Court.; *P. speciosissima*, Maund; *P. Bridgesii*, *P. Broughtonii*, Marn.; *P. Van Houttei*, *P. Marianna*, Lindl.; *P. insignis*, De Jonghe; *P. Oldryana*, Walp. Several other old Latin names are also referable to this hybrid group.

DD. *Infl. small and loose or flat-topped: plants lower.*

4. *ovata*, Linn. (*P. carolina*, Linn. *P. triflora*, Maund). A foot or two tall, the sts. erect from a short decumbent base, glabrous or very nearly so: lvs. narrow-ovate to oblong-lanceolate, the lower ones tapering to base and the upper ones somewhat clasping: fls. pink or light red, about 1 in. across, the straight or slightly curving tube twice or more longer than the rather short and broad calyx-teeth. Pa. to Ala., mostly in elevated regions. B.M. 528. Gn. M. 2:168.

5. *glaberrima*, Linn. Fig. 2912. Differs in somewhat taller growth, linear-lanceolate to narrow-lanceolate taper-pointed firm nearly veinless lvs. which have revolute margins, and in the narrow very sharp-pointed calyx-teeth. Va. to Wis., and south to Fla.

Var. *suffruticosa*, Gray (*P. suffruticosa*, Vent. *P. nitida*, Pursh). Stiffer, sometimes pubescent above: lvs. considerably broader: fls. varying to flesh-color. Ga. and Tenn., south and west. B.M. 1344 (as *P. carolina*), and B.R. 68.



2913. *Phlox divaricata* ($\times \frac{1}{2}$).

cc. Plant distinctly hairy or pubescent (exceptions in No. 9).

d. Sterile, prostrate or running shoots arising from the base of the plant.

6. *divaricata*, Linn. (*P. canadensis*, Sweet). WILD SWEET WILLIAM. Fig. 2913. Sts. slender, pubescent, 10–18 in. tall: lvs. varying from linear-oblong to ovate-lanceolate, mostly acute: fls. in small cymes terminating short branches, 1 in. across, blue or pinkish blue, handsome and somewhat fragrant, the corolla-lobes often notched, the calyx-lobes narrow and subulate. Woods and copses, in lowish grounds. Que., west and south, to Fla. and La. B.M. 163. G.F. 7:256 (reduced in Fig. 2913). Gn. 60, p. 251; 76, p. 45. G.L. 18:335. G.W. 2, p. 555. R.B. 24:185. Gn.W. 23:433. Gn.M. 2:167.—A very attractive early spring fl., often coloring the floor of woods. Prefers rich soil. Var. *Láphamii*, Wood. Lvs. ovate: fls. bright blue; petals obtuse and entire. This name is listed abroad; plant said to be stronger-growing and with longer-blooming season than the species. G.M. 55:556.—*P. divaricata* has received considerable attention from cultivators abroad.

7. *stolonifera*, Sims (*P. reptans*, Michx.). Low and weak, the flowering sts. reaching 6–12 in., the sterile ones long and prostrate, the plant thinly glandular-hairy: lvs. short-ovate or obovate, more or less obtuse: fls. few in each cyme, purple or violet, the lobes mostly

entire, the calyx-lobes narrow and subulate. Pa. and Ky. to Ga., mostly in the upper regions. B.M. 563. Var. *véna*, Hort. (*P. véna*, Hort.), has rose-colored fls. with dark purple throat; a garden form.

dd. Sterile prostrate shoots none.

8. *amœna*, Sims (*P. Wàlteri*, Chapm. *P. involu-cràta*, Wood). Sts. 6 in. or less high from a decumbent base, pubescent or hairy: lvs. numerous, mostly in rosettes at the base, few on the flowering sts., small, oblong-lanceolate to linear-oblong, mostly obtuse but sometimes nearly or quite acute: fls. numerous for size of plant, purple, pink or white, lobes usually entire, calyx-lobes narrow and sharp-acute. Dry lands, Va. to Ky. and south. B.M. 1308. G.M. 56:157. Var. *foliis variegàtis*, Hort., with lvs. variegated, is listed.

9. *pilòsa*, Linn. (*P. aristàta*, Michx. *P. cuspidàta*, Scheele). Sts. slender but erect, 2 ft. or less tall, pubescent or hairy (nearly glabrous forms occur): lvs. small, linear or linear-lanceolate, widest near the base, acuminate: fls. numerous in rather loose cymes, varying through purple, pink and white, the lobes entire, the calyx-lobes awn-like. Dry fields, woods, Ont. and Man. to Fla. and Texas, growing as far east as N. J. B.M. 1307. L.B.C. 1251, 1731. G.L. 27:117. Gn.W. 23:495.

bb. Flowering sts. diffuse and branching, often creeping, low, sometimes caespitose: plants of more or less tufted habit.

c. Corolla-lobes 2–3-parted or very strongly notched.

10. *bifida*, Beck. Low, the sts. stiff and sometimes almost woody and often 1 ft. long and rising 3–8 in. from the ground, minutely pubescent: lvs. linear and rigid, 2 in. or less long: fls. scattered, violet-purple, the lobes 2- or 3-cleft as far as the middle or farther into narrow spreading segm. Prairies, Mich. to Mo. and Tenn.—Rarely cult.

11. *Stellària*, Gray. Fig. 2914. Stellaria-like: glabrous: lvs. linear, sparingly ciliate toward the base: fls. scattered, usually long-peduncled, pale blue to whitish, the lobes cleft only at the apex into short oblong parts. Lexington, Ky., to S. Ill. and Tenn. G.F. 1:257 (adapted in Fig. 2914).—How much, if any, of the *P. stellaria* of the trade is this species and how much is forms of *P. subulata*, is to be determined.

cc. Corolla-lobes shallow-notched or entire.

d. Peduncles usually bearing few to several slender-pedicelled fls.

12. *subulàta*, Linn. (*P. setàcea*, Linn.). GROUND PINK. MOSS PINK. Fig. 2915. Tufted or matted species, in many forms, the depressed sts. more or less



2914. *Phlox Stellaria* ($\times \frac{1}{2}$).

pubescent: lvs. crowded or fascicled (except on the flowering sts.), narrow-linear to linear-lanceolate, very sharp and usually stiff, ciliate: fls. nearly 1 in. across, light blue, pink or white, in small clusters standing 2-6 in. above the ground, the lobes obovate or entire. Dry banks and fields, N. Y., west and south, reaching Fla.; run wild in patches along many roadsides, in cemeteries, and elsewhere. B. M. 411 and 415. Gn. 67, p. 218; 71, p. 166; 75, p. 29. F. W. 1878, frontis. Gn. M. 2:167. G. L. 22: 356.—A much-prized old garden plant, useful for colonizing where it is desired to cover the earth with a mat. It blooms profusely in spring. The garden forms are many, as: Var. *nivalis*, Hort. (*P. nivalis*, Lodd.), white-fl., style short; ovules commonly 2 or 3 in each cell. L. B. C. 8:780. Var. *aristata*, Hort. (*P. aristata*, Lodd.), has fls. pure white, sometimes lilac-tinted; ovules 1 in each cell. L. B. C. 18:1731. Var. *Nelsonii*, Hort., (not *P. Nelsonii*, Brand), white, with rose-red eye; compact. G. W. 15, p. 430. Gn. 75, p. 275. Var. *Héntzii*, Voss (*P. Héntzii*, Nutt.), lobes entire or nearly so, white, lavender or purple. Southern states. Var. *annulata*, Hort., whitish blue, with purple ring. Var. *atropurpurea*, Hort., rose-purple with crimson ring. Var. *grandiflora*, Hort., fls. large, red; plant dwarf. Var. *stellaris*, Hort., with star-like white fls. in profusion. Var. *caerulescens*, Hort., with bluish fls. Var. *pallida*, Hort., large-fl., rose-colored shaded lilac. Var. *frondosa*, Hort., vigorous form; fls. pink with dark center. Var. *lilacina*, Hort., compact, lilac-fl. G. C. III. 41:383. G. M. 55:283.—Some of the foregoing forms are described or listed as if derived from *P. Stellaria*; but whether from the species *P. Stellaria*, Gray, or the race of *stellaria* or *stellaris* of *P. subulata*, is not always clear.

DD. Peduncles chiefly axillary and mostly 1- to 3-fl., or the fls. nearly sessile.

E. Lvs. crowded or fascicled: plant forming a mat or tuft.

13. *Douglasii*, Hook. Very low and densely tufted, pubescent or nearly glabrous: lvs. very narrow, pointed, the margins at base often ciliate: fls. small and short-stalked, purple, lilac or white, about 1/2 in. across, the lobes

obovate and entire, the tube little exceeding the calyx. Utah and Mont., west. Gn. M. 2:168.

14. *multiflora*, A. Nelson. Somewhat similar in habit to *P. subulata*, producing large fls. in spring so freely as to hide the foliage: caespitose, the branching prostrate base woody, the herbaceous nearly erect shoots 2-4 in. high, the branches simple and 1-fl.: lvs. broad-linear, glabrous, opposite or fascicled: fls. rose, lilac or lavender, fragrant; tube of corolla exceeding calyx, the lobes 3/4 in. long, obovate and entire. Foothills Colo. to Mont.—Offered in the W.

EE. Lvs. little if at all fascicled: plant only loosely tufted.

F. Style nearly or quite equaling the corolla-tube.

15. *adsurgens*, Torr. Fig. 2916. Sts. 3-6 in. long, diffuse and ascending, glabrous except the peduncles and calyx: lvs. ovate-lanceolate or ovate, acute, less than 1 in. long: fls. rose-colored or whitish, nearly or quite 1 in. across, the obovate lobes entire, the tube nearly twice longer than calyx. Ore., in Cascade Mts. G. F. 1:66 (adapted in Fig. 2916).

FF. Style very short.

16. *speciosa*, Pursh. Variable in size, sometimes ascending to 3 ft., more or less glandular above: lvs. 2 in. or less long, linear to lanceolate, the uppermost broad at base: fls. rose-pink or whitish, in corymbs, the lobes obovate, the tube little surpassing the calyx. Ariz. and Calif. to Wash., in many forms.

17. *nana*, Nutt. (*P. triovulata*, Thurb.). Fig. 2917. Only a few inches high, glandular-pubescent: lvs. 2 in. or less long, linear, sometimes alternate: fls. light red or rose to white, scattered or somewhat corymbose, about or nearly 1 in. across, the lobes usually entire and roundish, the tube somewhat surpassing the calyx. Texas to Ariz. G. F. 1:413 (adapted in Fig. 2917).

Many other species may be expected to appear in the lists of dealers, and there are many Latin names of domestic forms of *P. Drummondii*, *P. paniculata-maculata*, *P. subulata*.—*P. Arendsii*, Hort. A summer-flowering dwarf perennial phlox originating with G. Arends, Germany, said to be hybrid of *P. divaricata* (*P. canadensis*) and *P. paniculata* (*P. decussata*). Sts. stiff and wiry, about 2 ft. high: fls. lavender, mauve and violet, in flattish or rounded heads.—*P. Brittonii*, Small. Of the *P. subulata* set, growing on dry mountain slopes in Va., W. Va., N. C.: corolla-lobes deeply emarginate rather than shallowly emarginate or entire as in *P. subulata*: upper part of plant glandular: fls. mostly white, with 2 magenta spots at base of lobes: lvs. numerous, subulate or nearly so.—*P. cdrnea*, Sims. Probably a hybrid of *P. maculata* and *P. glaberrima*: 1 1/4-3 ft., erect, st. not spotted: lower lvs. narrow-lanceolate to linear, the upper ones oblong: fls. rose-colored to purplish, in terminal corymbs, on very short pedicels. Southern states. B. M. 2155. L. B. C. 8:711.—*P. criterion*, Miell. Like *P. Drummondii*, but peren-



2915. *Phlox subulata*. (X 1/4)



2916. *Phlox adsurgens*. (X 1/4)



2917. *Phlox nana*. (X 1/4)

nial: perhaps hybrid of *P. paniculata* and *P. Drummondii*. F.S. 8:800.—*P. Lindsayana*, Hort., apparently of the *P. subulata* group, said to be a hybrid and useful for rockery and border.—*P. sibirica*, Linn. The one Asian species, occurring also in Alaska: a low loosely caespitose species, 6-9 in. high, white-fl., mostly villous-pubescent: lvs. narrow-linear: corolla-lobes obovate or emarginate.

L. H. B.

PHOENICOPHORUM: *Stevensonia*.

PHOENIX (Theophrastus gave this name to the date palm, perhaps thinking of Phoenicia, where the Greeks were supposed first to have seen it, or of the Phœnician purple, or of the fabled bird of Egypt). *Palmaceæ*. A distinct and exceedingly useful genus of palms, planted for fruit, ornament and shade.

Palms with sts. spineless (in many species the lower lfts. are reduced to long stout spine-like processes), without trunks, or with stout or slender, short or long, erect or inclined trunks, often caespitose, clothed above with the persistent bases of the lvs.: lvs. terminal, spreading, recurved, unequally pinnate; segms. somewhat fasciculate or almost equidistant, elongated-lanceolate or ensiform, acuminate, rigid, inserted by the wide base; margins entire or folded on their entire length; rachis laterally compressed, convex on the back; petiole plano-convex, usually rigid spiny, with very short rigid pinnae; sheaths short, fibrous: spadices usually many, erect or nodding in fr., or pendent, appearing among the lvs.: peduncle strongly compressed: branches usually somewhat umbellate: spathe basilar, entire, long, compressed, 2-edged, coriaceous ventrally and at length dorsally divided; bracts usually obsolete; fls. small, leathery, yellow: fr. a berry or drupe, oblong, orange, brown or black, the seed always grooved.—Species 10-12, perhaps more, in Trop. and Subtrop. Asia and Afr. The botanical monograph of the genus Phoenix by Beccari (in *Malesia* 3:345) admits only 10 species, although there are about 60 names. Such a "lumping" of species is very unwelcome to the horticulturist, and it is probable that nearly all the synonyms cited below represent forms that are abundantly distinct for horticultural purposes. The following account of the genus is adapted from the work of Beccari, especially the Asiatic species. A good horticultural appreciation of Phoenix is that by William Watson, of Kew, in G.C. III. 9:234, 298, from which liberal extracts are made below. Phoenixes differ from all other pinnate-lvd. palms in having the lvs. folded upward and lengthwise, and in the peculiar form of the seed, as seen in the date stone. The plants are either male or female.

The fruits of only one species are used for food; viz., *P. dactylifera*. (For date-culture, see *Date*.) In England, only *P. rupicola* ranks among popular decorative plants. Of all palms, the cultivated species of Phoenix are the most difficult to define. Many hybrids have been raised in the gardens of the Riviera, where several species flower and fruit every year. It is almost impos-

sible to keep these pure. Kerchove records the wonderful fecundity of a phoenix; *P. reclinata* at Nice fertilized with pollen from *P. tenuis*, *P. reclinata* and *P. pumila* produced 20,000 seeds. The raising of phoenixes from seed is done on a large scale on the Riviera. The seeds are sown in beds in the open and the seedlings transplanted into shallow trenches like celery, so that the trenches may be regularly flooded during the summer drought. Next to the coco-palm, the date is one of the most useful trees in the world. *P. canariensis* is the noblest of all phoenixes, and one of the most majestic palms in cultivation. Its rate of growth is astonishing: a tree supposed to be only ten years old had a trunk 4 feet high, 3 feet in diameter at the base, with about one hundred leaves forming a head 25 feet across. Another specimen of about the same size bore eight bunches of fruit, each weighing about fifty pounds. *P. sylvestris* is the wild date of India, where it is cultivated for its

sap, which yields sugar and "toddy." The trunk attains a height of about 4 feet when seven years old, and it is then tapped by cutting a notch in the stem at the top and catching the sap as it runs out. The tree continues to yield annually fifteen to eighteen gallons of sap for twenty to twenty-five years, or eight pounds of sugar a year. Many thousand tons of date-sugar are produced every year in Bengal alone from this and other palms. "*P.*

reclinata and *P. spinosa* are united under the former name by Beccari. Taking the dwarf, caespitose, shiny-leaved elegant plant found in Caffraria as far south as Gra-

hamstown, and comparing it with the tall, solitary stem, huge-headed, gray-green-leaved plant of the tropical regions of Africa, it is difficult to believe that they are merely forms of one species." An interesting novelty in phoenix is the plant known as *P. Roebelenii*, the pygmy phoenix (Fig. 2919.) Specimens twenty to thirty years old have stems not over 2 feet high. Watson says: "It is by far the smallest of all the many kinds of phoenix known, and is also exceptional in the form of its stem and in the elegance and soft texture of its bright green leaves." Watson adds that

it deserves to rank with *Cocos Weddelliana* and *Geonoma gracilis* for usefulness in a small state. This palm suckers freely and in a wild state grows in clumps. *P. Roebelenii* is often treated as a variety of *P. humilis*; but Watson and others think that it is a distinct species and that in the form and texture of its leaves it resembles *P. rupicola* more than any other species. Because of its distinctness horticulturally and the general uncertainty in the genus, it is advisable to keep *P. Roebelenii* distinct for the present at least. It is native in the Laos region of Indo-China, where it was discovered by Mr. Roebelin, who went there regularly every year and exported the seed to Europe by way of Bangkok. It is specially abundant in the Nam Ou River Valley, and occurs also toward Pac Lay.

The botany of Phoenix is much confused, and no one knows what is planted in this country under the different names. The species hybridize freely, and it is probable that most of the cultivated forms are hybrids



2919. *Phoenix Roebelenii*.

of various mixtures. While some of the garden names are considered by botanists to be synonyms, they may represent distinct plants to the horticulturist. Any treatment of Phoenix as represented in North America must now be tentative.

Cultivation of phoenix.

In Florida.—In moist land no special care is necessary in setting out these palms. All they require is shade after the planting of small specimens, and a mulch of old grass or stable-manure. They must be frequently tilled and fertilized. Always use a fertilizer rich in ammonia while they are making their growth. In autumn, a fertilizer containing 10 or 12 per cent of potash should be used, with a good addition of phosphoric acid. This will make the plants more hardy to endure occasional cold spells. On high dry pineland, holes 3 to 5 or 6 feet deep and wide should be dug for the large-growing species, and these holes should be filled with old stable-manure, bones, muck, and clay. Plant in a saucer-like depression about a foot deep in the center, and apply a heavy mulch of old stable-manure after the plant has been set out. If stable-manure is not at hand, old leaves and grass may be used instead. Small plants should be well shaded for a year or so, and they also should be kept constantly moist during the dry season. All hardy palms should be set out in November, December, and January. One is not likely to be successful in transplanting them in the dry season from March to June.—In Florida, experience has been had with plants under the following names: *P. canariensis* is the most beautiful as well as the most massive of the tall-growing single-stemmed species. The trunk in young specimens is immense. It is a fast grower in rich moist soils, but very slow and unsatisfactory in high dry sandy lands. It is excellent



2919. Phoenix Roebelenii of horticulturists, considered by some botanists to be a form of *P. humilis*.

as a single specimen on lawns, or for streets. Its dense immense crown of elegantly curving pinnate leaves, each often 15 feet long and of a very pleasing green color, and its stately and rapid growth, combine to make this species an ideal avenue tree for central Florida, along with *Sabal Palmetto*, *Washingtonia robusta* and *Phoenix sylvestris*. Farther south *Cocos plumosa* and *Oreodoxa regia* must be added. There are hybrids of this species and *P. sylvestris* and *P. dactylifera*. Seeds from the Riviera and Italy seldom produce plants true to name because the plants evidently are pollinated by the species mentioned. It is necessary to import the seeds

from the Canary Islands, if plants true to name are desired. *P. tenuis* is only a more slender form of it. *P. canariensis* is easily distinguished by its greenish yellow leaf-stalks and spines.—*P. sylvestris* is a very stately and beautiful palm with light bluish green leaves, growing well on high pineland but doing best on rich moist soils. There are hybrids between this species and *P. canariensis*.—The date palm, *P. dactylifera*, is common in many gardens, the product of seeds taken from the commercial dates bought in the shops. Most of the real date palms do not look beautiful. They are rather coarse, but a few of them show a dense crown of deep bluish green leaves. It often produces large bunches of orange-yellow juicy but rather bitter fruit. The mocking-birds are very fond of it. The foregoing three phoenixes are hardy as far north as Jacksonville. The remainder are all more tender.—*P. reclinata* is a most beautiful palm with slender stem and a dense crown of reclining leaves. Great confusion exists concerning this fine palm, as quite a number of the species having more massive stems and much broader and more spiny leaves are labelled with this name. The true *P. reclinata*, as understood in Florida, has soft leaves, and the leaflets are scarcely spiny. Although it suckers, the offsets are not so abundant or so vigorous as in the plant known as *P. spinosa*. It is really a one-stemmed species. The trunk is very slender, scarcely more than 4 or 5 inches in diameter. It grows as well on high dry pineland as in moister and richer soil, but the growth is much more rapid in good soil.—*P. spinosa*, from a horticultural standpoint, is very distinct from the last. The leaves are very vigorous, deep green and each leaflet terminates in a very sharp spine. The foliage is so extremely spiny that it is very difficult to trim the plants. This palm always grows in clumps of five or six or more stems, and it attains a height of 25 to 30 feet. The trunks are rather rough and massive, 9 or 10 inches in diameter, and the leaves are recurving, as in the last.—*P. farinifera*, or the palm grown in Florida under this name, is similar in growth to *P. spinosa*, but the leaves are lighter green with a slight glaucous hue, and the spines on the leaflets are even more formidable. The leaves, particularly at their lower end, are covered with a fine mealy substance.—*P. zeylanica* is one of the most beautiful and distinct of all the phoenixes, with the color of the Colorado blue spruce. If single stems are desired, the suckers should be removed as soon as they appear. This species thrives on high and low land.—*P. leonensis*, by botanists referred to *P. reclinata*, grows in large dense clumps 10 to 12 feet high, scarcely forming trunks. The leaves are deep green, rather soft to the touch and not spiny. Only the petioles are provided, as in all these palms, with formidable spines. It blooms in spring, and fruits abundantly in winter. It grows evidently best on high pineland.—*P. paludosa* forms large clumps, and massive trunks from 1 to 1½ feet in diameter and 15 to 25 feet high; a strong grower but rather coarse in appearance. It grows well on high and low lands.—*P. acaulis* does not form trunks. It is a low, very rigid little palm. The leaves are so spiny that it is difficult to walk among the clumps.—*P. rupicola* (*P. cycadifolia*) is the most elegant and beautiful of all the phoenixes in central Florida. Specimens 6 to 7 feet high look extremely beautiful. The leaves are glossy green and very smooth, suggesting the foliage of some species of *Cycas*. They are elegantly curving to all sides, and as the leaflets are all arranged horizontally in one plane, well-grown specimens form objects of great beauty. It grows well only in rich moist soil and half shade.—*P. Roebelenii* is a dainty little phoenix now represented in many Florida gardens, but it grows well only in rich moist soil and in half-shady spots. It excels all other small palms in grace, elegance, and beauty. (H. Nehrling.)

In California.—The number of species and varieties of phoenix grown in California is a problem so complex

that one dares not attempt a solution. The nursery trade recognizes the following names: *P. canariensis*, *P. cycadifolia*, *P. dactylifera*, *P. leonensis*, *P. Roebelenii*, *P. reclinata*, *P. rupicola*, *P. sylvestris*, and *P. tenuis*. Occasionally other names are met with in private collections, but no others appear in California plant catalogues. All are considered hardy except the dwarf *P. Roebelenii*. Specimens of *P. dactylifera* grow as high as 100 feet. Some specimens grown from seed saved from commercial dates have made

50 feet of trunk in thirty years, while others of the same seeding have made but 8 feet. Either there are numerous hybrids in California or else some species that no one knows. Specimens are known in all shades of green and glaucous-green, all habits of growth, stiff and upright, pendulous and soft, narrow leaves and broad ones, slim-folded and wide-spreading, the latter like an inverted leaf of *Jubæa spectabilis*. No one has attempted to straighten them out. The only species easily recognized everywhere and by everyone is *P. canariensis*, the gem of the genus. This is regarded by one eminent Californian nurseryman as a garden hybrid, but it always produces fertile seeds, and seedlings from it do not vary, which cannot be said of any other phœnix here. Next in popularity comes *P. reclinata*; the others are found only in collections. *P. canariensis* is most easily removed from the ground, and the best time is August and September, the hottest weather, as then they recuperate faster. The only other time to remove is in the early spring, before growth, and then if the weather turns cold it is dangerous. (Ernest Branton.)

In the North.—Although phœnixes cannot be considered to be as decorative subjects as the howeas and chrysalidocarpus, they are among the hardiest of palms. For any unfavorable situation where any palm can be expected to thrive, recommend a phœnix. Outdoors they endure the hottest sunshine without losing a particle of color, whether placed in jars, vases, or beds. As house-plants they are unequaled for resistance to neglect. They also bear the tying and untying and the crowding and wear and tear of public decorative work better than any other palms. The date palm is not quite so graceful as *P. rupicola*; *P. leonensis*, or *P. spinosa*, is slightly stiffer than *P. rupicola*, but very handsome. Other kinds useful to the florist are *P. canariensis*, *P. farinifera*, *P. pumila*, and *P. tenuis*. (This paragraph has

been adapted from an article in Scott's "Florists' Manual" which embodies the experience of Mr. Scott and of the undersigned. (W. H. Taplin.)

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(Various other names will be found in horticultural literature, but the following comprise those known to the American trade.)

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rupicola, 1.
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A. Texture of lfts. flaccid.

1. *rupicola*, T. Anders. (*P. Andersonii*, Hort. Calcutta. *P. cycadifolia*, Hort.?).

St. 15–20 ft. by 8 in., solitary, slender, naked: lvs. 10 ft., glabrous, bright green: petiole compressed; segms. $1\frac{1}{2}$ ft., 2-ranked, not fascicled, flaccid, bright green: fr. oblong, shining yellow. Sikkim, Himalaya. G.C. II. 8:45. F. 1887, p. 165. I.H. 25:318. F.R. 1:143. A.G. 13:141. A.F. 4:569. Gn.M. 6:288. G.Z. 22, p. 97. R.H. 1912, p. 150. G.W. 1, p. 35.—A form with some of the lfts. white is figured in I.H. 34:3.

AA. Texture of lfts. rigid.

B. Arrangement of lfts. 2-ranked.

C. Form of lfts. lanceolate.

2. *reclinata*, Jacq. (*P. leonensis*, Lodd. *P. senegalensis*, Van Houtte. *P. spinosa*, Schum. & Thom. *P. zanzibarensis*, Hort.). St. to 25 ft. or more: lvs. 2-ranked, bright green, obliquely arcuate-recurved toward the apex; lfts. rigid, approximate, strict, 12 in. long, 1 in. wide, lanceolate, acuminate, pungent, the terminal 9 in. long, slightly

bifid, the lowest spinescent. Trop. and S. Afr. F. 1871, p. 135. A.F. 4:568. A.G. 13:141; 14:410; 16:346. G. 10:409. Gt. 51, p. 623. Gn. 39, p. 140. R.B. 37, p. 334. R.H. 1911, p. 103.—*P. melanocarpa*, Naudin, has black edible frs.; found in garden at Nice. It is "supposed to be a variety of *P. senegalensis*," or by some a hybrid of *P. dactylifera*. R.H. 1894, pp. 493, 496, 497.

cc. Form of lfts. ensiform, with filiform tips.

3. *paludosa*, Roxbg. In groups in the wild state, almost tree-like: trunks 8–25 ft. high, 3–4 in. diam., often reclining, annulate: lvs. 8–10 ft.; lfts. 1–2 ft.,



2920. Phœnix palm.—An unusually straight-trunked specimen of the *P. dactylifera* group.

opposite and alternate, 2-ranked, ensiform, with filiform tips, whitish or mealy beneath; petioles 3-5 ft. long, slender, scurfy, with many long spines; sheath fibrous: fr. black-purple. Along rivers and bays. Trop. Asia. R.H. 1912, p. 423.

BB. Arrangement of lfts. 2-4 or many-ranked.

c. Position of lfts. equidistant.

D. Color of lvs. dark green.

4. *pusilla*, Gaertn. (*P. farinifera*, Roxbg.). Shrubby: caudex at most 4 ft., thickly clothed with old lf.-sheaths: petiole with 1 or 2 pairs of spines; lfts. subopposite, 4-ranked, ensiform, rigid, pungent, dark green: fr. black. Ceylon and S. India.—The caudex is said to have a farinaceous pith, and the foliage to be so spiny that it is impossible to walk through clumps of it.

DD. Color of lvs. light green.

5. *zeylanica*, Hort. (*P. pusilla*, Becc., not Gaertn.). St. 8-20 ft. high, rarely much shorter: lvs. rather short; lfts. very many, subequidistant, 7-10 in. long, bright green, quadrifurcately inserted, linear-lanceolate: fr. obovoid-oblong, red at length violet-blue, ½ in. long. Ceylon.—Fr. edible.

CC. Position of lfts. grouped or fascicled.

D. St. bulbiform: lvs. short.

E. Lfts. scattered, irregularly fascicled.

6. *humilis*, Royle. Sts. short, tufted, bulbiform, rarely elongated: lvs. subglaucous; lfts. scattered, interruptedly fascicled. Very close to *P. acaulis*, but distinguished by the very long-peduncled, fruiting spadix. Hilly districts of India. Var. *Hanceana*, Becc. (*P. Hanceana*, Hort.), from China, is cult.

7. *Roebelénii*, O'Brien. Figs. 2918, 2919. Lvs. 1 ft. or more long; lfts. 5-7 in. long, shining, dark green, soft, curved, subglaucous, often approximate, mostly falcate, not spinous at the tip. Assam to Cochinchina. G.M. 38:80; 53:996. A.G. 15:201. G.C. III. 6:475; 11:731. G.F. 3:273 (adapted in Fig. 2918). A.F. 38:284. G. 22:147; 37:377. Gn. 65, p. 309. Gn.M. 6:289. J.H. III. 64:76. Gt. 61, p. 392.—This dwarf palm, like a date palm but only about 2 ft. high, is variously understood. Beccari, in Webbia, vol. 3 (1910), treats it as a valid species; but Blatter subsequently, in Journ. Bombay Nat. Hist. Soc., makes it a synonym of *P. humilis* var. *Lourierii*, Becc.

EE. Lfts. in nearly opposite fascicles.

8. *acathlis*, Buch. Caudex bulbiform, 8-10 in. diam., densely clothed with sheaths and bases of spiny petioles: lvs. 2-6 ft.; lfts. in subopposite fascicles, many-ranked, ½-1 ½ ft. long, very rigid, somewhat glaucous, marginal nerve very strong; petiole 1 ft. or more, with many spines: fr. bright red to blue-black. India.

DD. St. erect: lvs. long.

E. Lvs. very slender.

9. *pumila*, Hort. St. slender, graceful, 6-10 ft.: lvs. 10-16 ft. long, recurved, drooping; lfts. 8-12 in. long, 4-ranked. Gt. 20, p. 173 (desc.).

10. *canariensis*, Hort. (*P. tenuis*, Versch. *P. Jubbæ*, Webb). Resembling *P. dactylifera*, but more slender and graceful in all its parts: lvs. more numerous. Canary Is. R.H. 1888:181; 1893, pp. 126, 127; 1912, p. 77. G.C. III. 15:405; 32:81; 54:433. V. 19:51. Gng. 5:215; 12:657. Gn. 57, p. 255. A.F. 22:659. G.W. 8, pp. 26, 28. G. 3:379 (as *P. tenuis*). J.H. III. 68:446. Var. *macrocarpa* is cult. in Florida.

EE. Lvs. more robust.

F. Foliage glabrous.

11. *sylvestris*, Roxbg. St. solitary, stout, 25-40 ft. high, clothed with persistent petiole-bases, the crown very large: lvs. 10-15 ft., glabrous, grayish green;

petiole spiny; lfts. 1-2 ft., fascicled, 6-18 in. long and ¾-1 in. broad, 2-4-ranked, rigid: fr. orange-yellow, the seed rounded at both ends, pale brown. Very close to *P. dactylifera* and perhaps the origin of that plant. India. I.H. 10:351. V. 16:101. F. 1872, p. 29. Gn. 54, p. 117. G.C. III. 10:105. G. 1:248; 9:116. R.H. 1912, p. 149. —A hybrid of *P. sylvestris* and *P. canariensis* secured by E. H. Hart is highly praised.

FF. Foliage glaucous.

12. *dactylifera*, Linn. (*P. cycadifolia*, Hort.). DATE PALM. Fig. 2920. St. erect, to 100 ft. and more: lvs. glaucous, arcuate-ascending; lfts. linear-lanceolate, acuminate, 8-16 in. long, strongly complicate, the lower 4-ranked, the upper 2-ranked, irregularly and remotely aggregate: fr. cylindrical-elliptical, 1-2 in. long. Arabia, N. Afr. R.H. 1893, p. 127; 1912, p. 109. G.W. 11, p. 24. Var. *excelsa*, Hort., is cult. in Fla. See Date.

P. andamanensis, Hort. Similar to *P. rupicola*, but more elegant, differing from those in cult. by the regularity of its pinnae and narrowness of the terminal one. Andaman Is.—*P. dumosa*, Hort. Saul, 1893. Of "dwarf habit." Seems unknown to botanists. —*P. natalensis* and var. *variegata* are offered, but no description is available. —*P. paradensis* is advertised. —*P. Sanderiana*. Presumably intro. within recent years by Sander & Co., St. Albans, England.

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PHOLIDOCÁRPUS (Greek, *scale* and *fruit*: the fruit is covered with a scaly coat). *Palmaceæ*. A palm of the oriental tropics. Trunk tall: lvs. orbicular, 4-5 parted; petiole spinous: fr. globose or ovoid with a tessellated pericarp; seed laterally inserted. About 5 species, Malaya, all very imperfectly known. One species, *P. Ihur*, Blume, is sometimes grown in the warm-house and may be suitable for outdoor growth in S. Calif. This has lvs. similar to those of *Borassus flabelifer*, the petioles are armed with stout spines, the spadix loosely branched and the drupe ovoid, about as large as a fair-sized hen's egg, the rind rugose and tessellated and has 3-4 seeds. Malaya.

PHOLIDÔTA (Greek, *scale* and *ear*: the scales of the unopened raceme are said to recall the rattle of a snake). *Orchidaceæ*. Orchids with the habit of *Cœlogyne*, to be grown in a warmhouse, 55° to 65°.

Rhizomes creeping: pseudobulbs consisting of a single internode: fls. small, short-pedicelled, in slender racemes, each with a large bract; sepals and petals short, broad; labellum excavated or sac-like; column very short, winged around the top.—A small genus containing about 20 species, natives of India, S. China, and the Malay Archipelago. For cult., use strong light rich potting material, broken pots, old dry cow-manure, plenty of drainage. Do not allow to become very dry.

imbricata, Lindl. Pseudobulbs oblong sulcate: lvs. oblong-lanceolate, plicate, 6-12 in. long: raceme long-peduncled, 3-8 in. long; fls. small, rather crowded on the raceme, white or yellowish, with a shade of violet. Feb.-May. India. B.R. 1213; 1777. L.B.C. 20:1934.

chinensis, Lindl. A small creeping epiphyte: pseudobulbs cespitose, 1-2-lyd.: lvs. oblong-undulate, acuminate: fls. greenish white, in drooping racemes not more than 2-3 in. long; sepals ovate; petals linear; labellum oblong, recurved.—This plant has long been known from Chinese drawings.

HEINRICH HASSELBRING.

PHORADÉNDRON (Greek, *tree thief*). *Loranthaceæ*. The mistletoe of E. N. Amer. is *P. flavescens*, Nutt. (*Viscum flavescens*, Pursh), Fig. 2921. It is parasitic on deciduous trees as far north as N. J. and S. Ind. and extending southward to Fla. and Texas; also Calif. F.R. 3:590. It makes dense bunches 1-3 ft. across, with thick oval or obovate yellowish green evergreen lvs. The forking twigs are terete, and break easily at the base. The fls. are diœcious, borne in very

short spikes or catkins: berries amber-white, globular, small. It is collected for Christmas greens (see *Greens, Christmas*). The Old World mistletoe is *Viscum*; see also *Loranthus*. (Trelease, *Phoradendron*, 1916.)

The phoradendrons are not cultivated. There are about 100 species of them, all American, largely tropical, but a few in the western states. The oak mistletoe of California is *P. villosum*, Nutt. A related genus is *Arceuthobium* (or *Razoumofskya*), extending across the continent of North America, but too small, or even minute, to have decorative value.



2921. American mistletoe.—*Phoradendron flavescens*. ($\times \frac{1}{2}$)

fleshy-rooted rhizome, long-ensiform, equitant, yielding an exceedingly tough fiber: scape tall and leafless, with caducous bracts, short-branched toward top: fls. dull red or yellow, in a terminal panicle, on jointed pedicels; perianth tubular and curved, of 6 segms. connate at base, the 3 inner ones long and spreading at tip; stamens 6, exceeding the segms.; ovary oblong and 3-angled and 3-celled, bearing a slender declinate style: caps. oblong or narrower, loculicidal, bearing many compressed black seeds.—Species 2, in New Zeal. and Norfolk Isl. These plants are popular outdoor subjects in Calif. and climates of like mildness, making very bold lawn clumps. In regions of cold winters, they are known as greenhouse tub-plants or as subjects for planting out in summer in subtropical bedding. They are prop. by seeds or division; if by the latter method, it is well that they be planted outdoors in sandy soil in May and divided in September.

For certain combinations and in places where it can have plenty of moisture, *Phormium tenax* is a valuable plant, having a very distinct and unusual character all its own. The type is easier of cultivation than the variegated kinds. Much better results can be secured by raising the typical form from seeds than by division. Seed sown in February and grown on rapidly will make good plants for bedding purposes the spring of the following year. The seedlings may be either planted out or grown in pots: in the latter case, give a rich compost and plenty of water after the plants have taken hold. With good treatment one may expect at the end of a year and a half a well-furnished specimen 3 to 3½ feet high in a 6-inch pot. If one can afford room in a warmhouse, so much the better. The variegated forms require partial shade and uniform moisture; they do not come true from seed. (J. F. Cowell.)

A. Lvs. to 9 ft. long (in the wild), deep green, glaucous beneath, usually margined with a colored line.

tanax, Forst. NEW ZEALAND FLAX. Fig. 2922, Robust: lvs. attaining 9 ft., 2-5 in. wide, flat above, dark green, margin and keel bright red or brownish:

PHORMIUM (Greek, *basket*; referring to one use to which this fiber plant is put). *Liliaceæ*. NEW ZEALAND FLAX. Very stout rigid perennial herbs prized in subtropical gardening, and in New Zealand used for fiber.

Leaves all radical from a short and stout branched

scape 5-10 or even 15 ft. high, terete and glabrous, reddish purple, bearing numerous fls. which are usually dull red but varying almost to pure yellow; perianth 1-2 in. long: caps. stout, erect or inclined, 2-4 in. long. B.M. 3199. Gn. 26, p. 397; 50, p. 369; 70, p. 99; 73, p. 123. G. 33:553; 36:554. F.E. 18:288. G.L. 27:219. A.F. 13:748. R.H. 1848:5. V. 13:340. Var. *atropurpureum*, Hort., has reddish purple foliage. R.H. 1877, p. 389. Var. *atropurpureum variegatum*, Hort., a "veritable fountain of white, purple and rose-color." Var. *atropurpureum nanum*, Hort., is a dwarf form. Var. *nigro-pictum*, Hort. (*P. purpureum nigro-limbatum*, Hort.). Lvs. deep green, with a narrow margin of blackish purple, which becomes broader and more distinct toward the base, making in mature plants a zigzag line which outlines the 2-ranked habit of the lvs. Var. *variegatum*, Hort., lvs. striped creamy yellow and white. R.H. 1878, p. 86. G.C. III. 29:169. Var. *Veitchianum*, Hort. (var. *Veitchii* and *P. Veitchianum*, Hort.), broad creamy white stripes on a light green ground. A.F. 5:39. The type and varieties all have the red margin. Var. *Powerscourtii*, Hort., differs from the type in narrower and more rigid lvs.; said to be hardier and freer-blooming. G.W. 1907, p. 3.—*P. tenax* is a most useful fiber plant in New Zeal., ranking in economic importance in the native flora only below the main timber trees.

AA. Lvs. to 5 ft. long, pale green, seldom glaucous or margined.

Cookianum, Le Jolis (*P. Colensoi*, Hook. f. *P. Forsterianum*, Col. *P. Hodkeri*, Gunn.). A smaller plant and less rigid: lvs. 2-5 ft. long, the apex usually much less split than in *P. tenax*: scape 3-7 ft. high, more slender, green, with smaller panicle: perianth 1-1½ in. long, yellower than the above: caps. long, pendulous, terete and twisted, 4-7 in. long. Var. *variegatum*, Hort., has yellowish white stripes. F.M. 1874:112. G.Z. 19:113. *P. flaccidum*, Hort., is presumably a form of this species.

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2922. *Phormium tenax*.

PHOTINIA (Greek, *photeinos*, shining; alluding to the shining foliage). Including *Heteromeles* and *Pourthiaea*. *Rosaceæ*, tribe *Pomeæ*. Ornamental woody plants, grown for their attractive flowers and fruits and the evergreen species also for their handsome foliage.

Deciduous or evergreen shrubs or trees: lvs. alternate, short-petioled, stipulate, usually serrate: fls. in corymbs or short panicles; petals 5, orbicular; stamens 10-20; styles 2, rarely 3 or 4, connate at the base: fr. a small, 1-4-seeded pome with persistent calyx and with the top of the fr. rounded and hollow.—About 30 species, nearly all in E. and S. Asia, only 2 in Calif. and Mex.

Closely allied to the *Aria* group of *Sorbus*, which differs chiefly in the top of the fr. being solid and pointed.

The photinias in cultivation are shrubs, rarely trees, with rather large evergreen or smaller deciduous leaves turning scarlet or deep red in fall and with white flowers in many-flowered or sometimes few-flowered corymbs followed by very attractive red or scarlet fruits. The evergreen species are tender in New England, and bear only a few degrees of frost; but the deciduous *P. villosa* is hardy as far north as Massachusetts, and is very conspicuous in fall by the scarlet coloring of the foliage and afterward by the numerous scarlet fruits, which retain their bright color until midwinter and are not eaten by birds. Of the evergreen species, *P. arbutifolia*, which is very similar to *P. serrulata* and also to *P. glabra*, is the best known; it is a very striking object in winter, with its large clusters of bright red fruit ripening in December and contrasting well with the glossy dark green foliage. The photinias are not very particular as to soil, but thrive best in a rather light sandy loam, and the deciduous ones prefer sunny positions. Propagation is by seeds or by cuttings of half-ripened wood under glass and by layers; also by grafting on hawthorn or quince.

A. Lvs. deciduous: fls. in corymbs or umbels. (Pourthiæa.)

villôsa, DC. (*P. variabilis*, Hemsl. *Pourthiæa villosa*, Deane. *Sorbus terminalis*, Hort.). Upright shrub, to 15 ft., with slender spreading or upright branches, or small tree: lvs. short-petioled, broadly obovate to oblong, cuneate, acuminate, sharply serrate, dark green and glabrous above, more or less pubescent beneath when young, $1\frac{1}{2}$ –3 in. long: fls. white, in $1\frac{1}{2}$ –2-in.-broad, glabrous or villous corymbs terminal on short lateral branchlets: peduncles warty: fr. about $\frac{1}{2}$ in. long, bright scarlet. June; fr. in Oct. Japan, China. G.F. 1:67. S.I.F. 1:49.—A very variable species. Var. **lævis**, Dipp. (*P. lævis*, DC. *Pourthiæa arguta*, Hort.), Fig. 2923, has narrower lvs., only sparingly pubescent when young and soon glabrous, glabrous infl. and somewhat larger fr. G.F. 4:377 (adapted in Fig. 2923). Var. **snica**, Rehd. & Wilson. Shrub or tree, to 30 ft.: lvs. thinner, elliptic or elliptic-oblong, sparingly pubescent at first, soon glabrous: infl. an umbel-like 5–8-fld. raceme, rarely corymbose, to 15-fld., loosely villous. Cent. China.

subumbellata, Rehd. & Wilson. Slender-branched shrub, 3–10 ft.: lvs. very short-stalked, elliptic-ovate to rhombic-ovate, acuminate, broadly cuneate or rounded at the base, sharply serrulate, glabrous, bright green above, pale or glaucescent beneath, $1\frac{1}{2}$ –2½ in. long: fls. in umbel-like 2–9-fld. glabrous racemes subtended by 2–3 crowded lvs.; pedicels slender, $\frac{1}{2}$ –1 in. long: fr. ovoid, nearly $\frac{1}{2}$ in. long, scarlet. May, June; fr. in Oct. Cent. China.

AA. Lvs. evergreen: fls. in broad panicles.

B. Stamens 20. (Euphotinia.)

c. Petioles longer than $\frac{1}{2}$ in.: lvs. usually 4–6 in. long.

serrulata, Lindl. (*P. glabra* var. *chinensis*, Maxim. *Cratægus glabra*, Sims, not Thunb.). Shrub, to 20 ft., quite glabrous: winter buds about $\frac{1}{2}$ in. across, ovoid: lvs. with about 1-in.-long petioles, oblong, usually rounded at the base, acuminate, serrulate, dark green and shining above, yellowish green beneath, 5–7 in. long; petioles about 1 in. long: panicles 4–6 in. broad, with thickish and slightly angular branches; fls. $\frac{1}{4}$ in. across: fr. globose, $\frac{1}{4}$ in. across, red. May–July. China. B.M. 2105. L.B.C. 3:248. L.D. 8:554 (all as *Cratægus glabra*). G.W. 15, p. 247.—Stands fairly well in Washington, D. C.

Davisoniæ, Rehd. & Wilson. Tree, to 45 ft.: winter buds minute, acutish: branchlets appressed-pubescent while young: lvs. oblong-lanceolate or oblong, acuminate or acute cuneate at the base, serrulate, lustrous and bright green above, paler beneath and pubescent on

the veins at first, soon glabrous, 3–5 in. long; petioles about $\frac{3}{4}$ in. long: panicles 4–5 in. broad with slender terete branches, sparingly pubescent; fls. nearly $\frac{1}{2}$ in. broad: fr. subglobose, orange-red, $\frac{1}{2}$ in. across or slightly more. May: fr. in Oct. Cent. China.—One of the handsomest evergreen trees of Cent. China; recently intro.; probably as hardy as the preceding species.

cc. Petioles shorter than $\frac{1}{2}$ in.: lvs. usually 2–3 in. long.

glabra, Maxim. (*Cratægus glabra*, Thunb. *Sorbus glabra*, Zabel). Shrub, to 8 ft.: lvs. on nearly $\frac{1}{2}$ in.-long petioles, elliptic or obovate to oblong-obovate, cuneate at the base, acuminate, serrulate, 2–3½ in. long: panicles 2–4 in. across; fls. $\frac{1}{2}$ in. across: fr. subglobose, red. May–July. China, Japan. S.I.F. 1:47.

BB. Stamens 10. (Heteromeles.)

arbutifolia, Lindl. (*Heteromeles arbutifolia*, Roem. *H. salicifolia*, Abrams. *Cratægus arbutifolia*, Ait., not Lam.). TOYON. TOLLON. Shrub or small tree, to 20 ft.:



2923. *Photinia villosa* var. *lævis*. (×¾)

young branches and infl. usually tomentulose: lvs. oblong to oblong-lanceolate, acute at both ends, sharply serrate, shining above, 2–4 in. long: fls. white, in 2–5-in. broad panicles; stamens 10: fr. bright red, $\frac{1}{2}$ in. across. June, July; fr. in Nov.–Feb. Calif. S.S. 3:193. B.R. 491.—Called Christmas berry in Calif., where the frs. are much used for Christmas decoration.

P. amphidoxa, Rehd. & Wilson (*Stranvæsia amphidoxa*, Schneid.). Shrub, to 10 ft.: lvs. deciduous, elliptic to oblong, serrate, loosely tomentose at first, soon glabrous, 2–3½ in. long: fls. 3–6; calyx densely tomentose: fr. subglobose, scarlet, $\frac{1}{4}$ in. across. Cent. China.—*P. arguta*, Wall. (*Pourthiæa arguta*, Deane.). Closely allied to *P. villosa*: lvs. longer and narrower, firmer, densely white tomentose beneath when young: corymbs larger. Himalayas.—*P. Beauverdiæna*, Schneid. Shrub or small tree, to 20 ft.: lvs. deciduous, oblong or obovate-oblong, densely serrulate, glabrous, 2½–4 in. long: corymbs 2 in. across: fr. subglobose, scarlet, $\frac{1}{4}$ in. across. Cent. China. Var. **notabilis**, Rehd. & Wilson (*P. notabilis*, Schneid.). Lvs. elliptic to obovate-oblong, 3–5 in. long: corymbs loose, 3–4 in. across: fr. ovoid, $\frac{1}{2}$ in. long. Cent. China.—*P. elliptica*, Nichols, is *Eriobotrya elliptica*, Lindl., a Himalayan species not in cult. in this country.—*P. japonica*, Nichols.—*Eriobotrya japonica*.—*P. parvifolia*, Schneid. Shrub, to 6 ft.: lvs. elliptic, long-acuminate, serrulate, nearly glabrous, 1¼–2 in. long: fls. 2–3 on filiform stalks 1–2 in. long: fr. ovoid, scarlet, $\frac{1}{2}$ in. long.

ALFRED REHDER.

PHOTOGRAPHY, HORTICULTURAL. As a means of description and of record, photography is of great importance to horticulture in all its branches. A reference to newspapers, magazines, and to trade catalogues of the day shows an almost universal use of the "half-tone" engraving process; and these engravings are merely photographs transferred to a copper plate, and by means of minute chemically-etched dots given a printing surface for the typographic press. Many other illustrations—notably many in this Cyclopaedia—are adapted from or drawn directly from photographs, being then engraved by another photographic etching process on hard zinc. Other processes are now employed, as yet principally for newspaper use, which transfer much of the beauty of the photograph through the photogravure method. As will be noted farther on in this article, there is also actual photography in colors now available. To a limited and decreasing extent, photographs are also printed on the prepared surface of boxwood blocks, and used in lieu of a drawing as a sketch for the wood-engraver.

Every experiment station and agricultural college finds in photography an indispensable adjunct both to its records and to its descriptive work. For the botanist, photography provides both an uniquely accurate means of recording plant details, and of portraying the appearance of the growing plant in its habitat. A photographic herbarium is an excellent supplement to the usual dried specimens of the botanist. Some of the larger nursery and seed establishments are also coming to maintain photographic equipments, in order that they may readily preserve views of the varieties which it is desired to advertise.

In horticultural journalism, photography is of prime importance. In advanced collegiate institutions and at the meetings of various progressive horticultural societies and institutes, the presentation of photographs by means of the stereopticon is found to be of enormous advantage, and the teaching or entertainment is made more efficient through this means. Recently, the motion-picture camera, through the use of which in connection with suitable projecting apparatus, operations in the field are presented a close simulation of actual life, has been availed of to advantage. For example, a "film" of considerable length records all the operations attendant upon the planting, cultivation and marketing or preserving of asparagus in the large areas devoted in California to the culture of that vegetable. A drama has been "staged" at a great gladiolus farm, and one rather grotesque film ingeniously recorded the seemingly accelerated growth of an unfolding lily and of a rose in the process of opening. Therefore, all branches of horticultural activity are concerned with photography, and the progressive instructor dealing with horticultural problems in an educational institution, or handling the government's money in the experiment-station work, must be able to practise at least some one photographic method with a fair degree of proficiency, if he is to accomplish the best results.

As horticultural photography differs essentially from the line of work in which the ordinary portrait photographer is engaged, some special skill and certain items of equipment are desirable for the tradesman, or experimenter, or teacher who wants to make his illustration effective. Those who deal with many photographs from many "artists," come to know the thoroughly inadequate work of the ordinary professional, who is fitted both as to equipment and skill only for the picturing of the human face and form. Not once in twenty times does satisfactory and efficient horticultural photographic work come from the professional; and, therefore, the horticultural instructor or tradesman is best served by taking up photography in an independent manner, if he gives the subject adequate attention.

Apparatus.

For views outdoors of trees, plants, and the like, any view camera of the regulation or of the "folding" type will answer, although, as it is often desirable to obtain relatively large details of fruits or flowers or plants *in situ*, a bellows of more than the usual focal capacity or length is preferred. The modern "long-focus" cameras are suitable, and the size most used by horticulturists is that taking a plate 5 by 7 inches in dimensions. For such size a rectilinear lens with a focal length of 7 or 8 inches is advisable; and if one of the two lenses forming the combination is available as an objective of about double the focal length of the combination, and the camera is provided with a bellows which draws out several inches beyond the focal length of this single lens, much facility in operation is provided. Any of the modern high-class view lenses are suitable, and those of the anastigmatic type, which are not only rectilinear but also render views in a flat and correct perspective, are preferable. It need not be assumed, however, that the very highest-grade lens is essential, for in the hands of a thoughtful and reasonably skilful operator, an ordinary rectilinear lens, costing, for the size mentioned, but \$15 or \$20, will often do satisfactory work. Whatever lens is used, it should be fitted into a quick-working shutter, as outdoor exposures, with modern rapid plates, must be made in small fractions of a second. The shutter, it may be explained to the unacquainted reader, is merely a convenient device for opening and closing the lens to the light for the interval of time desired by the photographer.

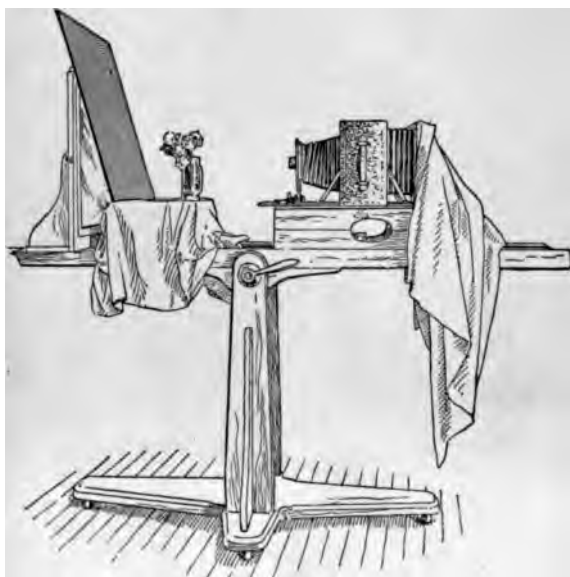
As there is frequent misconception of the work done by a lens, it may not be amiss to suggest to the inquiring horticultural photographer an investigation on his own account. The Photo-Miniature No. 140, "Lens Facts You Should Know," is a brief, clear, and concise statement of the principles, properties, and construction of lenses, which may be consulted to advantage. The focal length of any lens, in connection with the size of the plate upon which it is to be used, determines the angle and amount of view included. The human eye is a lens of about 16 inches focal length, and to have a photograph render perspective as seen by the average eye, an objective of the same focal length is required. Thus, on a 5 by 7 plate, a lens of 8 inches focal length will include twice as much in the view, and show it in half the size as seen by the eye. This forced perspective is sometimes desirable and sometimes unpleasant. If the 8-inch lens is composed of two elements on what is known as the symmetrical plan, the rear element may usually be used alone (by screwing out the front lens), and it will have approximately double the focus of the combination. This will give about the perspective seen by the human eye, and will need to be used in connection with a bellows of at least the same length or "draw" as the focal length of the lens. Some of the high-grade lenses are now made on what is termed the "convertible" plan, each of the two elements being of a different focal length. Thus a certain lens which as a whole is of 7½ inches focus, includes one element of 12 inches focus and one element of 18 inches focus. Either of these single lenses, or the combination, may be used separately, so that from a given position three views, including proportions differing as 5, 8, and 12, may be made.

To photograph an object in natural size, the double lens is preferable. If the lens is of 8 inches focus, it will give natural size when placed equidistant between the object and the ground-glass focusing-screen of the camera, at double its focal length. Thus the bellows would need to be drawn out so as to have 16 inches between the ground-glass and the lens, while the object to be photographed should be maintained in position 16 inches from the lens.

A tripod, capable of adjustment as to height, and of

sufficient rigidity to sustain the camera in a moderately high wind, is easily obtained. The cheaper forms are fairly efficient, but the photographer who has much traveling to do finds it preferable to obtain one of the more expensive and carefully fitted types, which fold into a smaller compass.

For indoor work, including the making of photographs of fruits, flowers, or plants in large detail, a special form of camera-stand is very desirable. One arranged so that the camera may be maintained in an inclined or nearly vertical plane, while the object to be photographed rests on a plate-glass exposing-stand in front of the lens, gives great facility and ease of operation, and does away with many difficulties of illumination. A few experiment stations possess devices of this kind. A form which has been found exceedingly satisfactory in practice is described in an out-of-print number of *The Photo-Miniature*, "Photographing Flowers and Trees," and is here reprinted by permission in Figs. 2924 and 2925, showing the camera-stand both as arranged for horizontal and for vertical work.

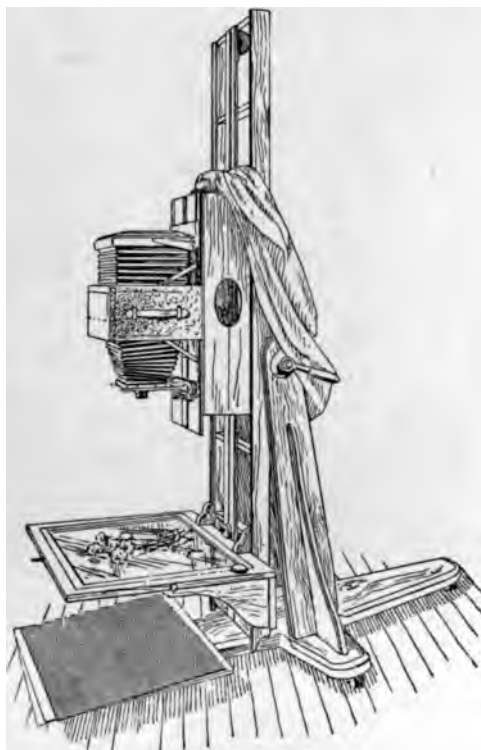


2924. Adjustable camera-stand, horizontal position.

In operation with this device the flower, fruit, or plant to be photographed is laid upon or placed in front of the plate-glass stand, and the camera, fastened by its tripod screw upon a movable bed, is adjusted as a whole, or through its bellows, until the desired size and focus are secured. The background may be varied as desired by cardboards or cloths placed out of focus in relation to the plate-glass stand. The camera-stand is mounted on casters, so that it may be readily moved about to secure the most favorable lighting. Objects which can best be handled on a horizontal plane may be disposed somewhat as shown in Fig. 2924. For work of this sort a north side-light is found vastly preferable to the conventional sky-light. A greater mistake in the equipment of a studio for horticultural work could not be made than to provide the sky-light deemed essential by old-fashioned professional photographers, although now happily abandoned by the more progressive workers for a "single-slant" light, which gives far better results. There should be provided in the workroom of the horticultural photographer several good reflecting surfaces, so that the side of the object opposite the main source of light may be properly illuminated.

All the apparatus above mentioned is applicable to color-photography by the Lumière method, as herein-after sketched; but motion-picture photography requires apparatus peculiar to itself.

Under certain conditions, the use of the "flashlight" methods may be advantageous in horticultural photography; as, when an outdoor object must be obtained at night, or indoors where a flower may wilt under prolonged exposure. Flashlight processes depend upon the explosion or the rapid combustion of certain metals—as magnesium—which, either alone or in combination with oxygen-giving chemicals, produce a light of great brightness and high actinic power for an instant. Further information upon flashlight may be found in



2925. Adjustable camera-stand, vertical position.

The Photo-Miniature No. 135, "Flashlight Photography."

The horticultural photographer also requires an outfit for developing and printing; but as this may be conventional, it is not deemed necessary to discuss it here.

Plates and color-values.

As practically all horticultural photography has to do with the tints of growing things, the well-known color inaccuracy of the ordinary dry-plate is a serious disadvantage. The ordinary plate responds most actively to the rays at the blue end of the spectrum, and is very sluggish in taking an impression from green, yellow and red, the latter color, indeed, being rendered practically the same as black. Yellow, which in actual color-value is on a par with light blue, and sometimes to the eye seemingly more intense than white, is rendered by the ordinary plate as a dark color, as all operators who have photographed yellow roses, yellow apples, yellow plums, and the like, will have observed. Fortunately, there are available photographic plates, known as isochromatic or orthochromatic plates, which, to a certain extent, correct these difficulties;

and the skilful operator may, by the use of the proper plate and in some cases a suitable ray-filter, give approximately correct values to all the colors of the spectrum. For all ordinary horticultural uses, when blue and yellow are not found in the same subject, the commercial orthochromatic or isochromatic plates of the most rapid speed are satisfactory. These give to yellow its proper value, at the same time improving the rendering of the green foliage and slightly increasing the truth of representation in pink, lavender, and the lighter red shades.

It is very much better, then, for the photographer who has to do with horticultural work to confine himself exclusively to these plates for all his work. If he has a subject including blue flowers, the especial activity of the blue rays, which otherwise would render the photographic impression as intense as if the object was white, can be restrained by a suitable ray-filter, which is applied in front of the lens. This ray-filter is either a glass cell filled with a 1 per cent solution of potassium bichromate, or a piece of plane optical glass covered with a suitably stained collodion film sealed with another optical glass and provided with a convenient mounting for slipping on the lens. (Such ray-filters may be commercially obtained at small cost, but ought to be known to be adequate for the particular plate to be used.) With this ray-filter and the plate before alluded to, the yellow is slightly over-valued, but the blue is given its proper relation. The beauty of outdoor photographs is vastly increased by the use of the plate and ray-filter mentioned, because a proper color-value is given to the sky, and the cloud-forms are preserved in all their attractiveness. If the subject is a heavily loaded peach tree, for example, the accentuation of the yellow, brought about by the use of the ray-filter, will give a needed slight exaggeration of color-value to the fruit, which, under treatment by an ordinary plate, will be almost indistinguishable from the mass of foliage. With the usual ray-filter the exposure required is practically trebled. In this *Cyclopaedia*, advantage has been taken of orthochromatic plates in photographing many of the subjects. The carnations, Plate XXII, Vol. II, show a variety of shades properly rendered by the means indicated. The grapefruit, Plate L, Vol. III, is an example of the use of the ray-filter also to obtain the full color-value of the fruit.

A difficulty known in photographic practice as halation must also be counteracted if the fine detail of subjects involving much light is to be preserved. Halation is caused by the reflection of brilliantly lighted objects from the back of the glass plate carrying the sensitive emulsion. Light possesses enormous velocity, and there is an almost inconceivably rapid play back and forth between the two surfaces of the glass plate, which is covered only on its face by the sensitive photographic emulsion. This results in a thickening of all the finer lines which should be rendered in the positive as white. It may be counteracted by "backing" the plate with a composition which will absorb all the rays of light that pass through the emulsion on the face; but in current practice a slightly less adequate and much more convenient prevention of halation is secured in the use of what are known as "double-coated" plates. A "slow" emulsion, first coated on the plate, is covered by a "fast" emulsion, with the effect of absorbing into the under-coating, in exposure, the overplus of light. These plates, incidentally, also give greater latitude of exposure, and their use is recommended, with the provision that both coatings should by all means be orthochromatic.

Even with the aid of the isochromatic plate and the ray-filter, the photography of shades of red is difficult, because of the lack of actinic or chemical quality in the red rays of the spectrum. In practice it is found necessary to give a very much prolonged exposure to objects containing red, and then to restrain the over-exposure

upon development by means of a suitably compounded developing solution.

Lantern-slides.

A lantern-slide is a positive on glass, and therefore is made from a negative. It is made preferably on a special plate, much slower than the regular photographic dry-plate, because coated with silver chloride rather than a silver bromide emulsion. The slide is usually faced with a paper mask, so as to include only the desired portions of the picture, and protected by a cover glass. Negatives of any size may be used if a suitable arrangement is provided for reduction. This can readily be arranged by an adaptation of the camera-stand illustrated in Fig. 2924. A pair of light bars is added, running from the top of the plate-glass frame to a support at the other end of the stand, and a piece of heavy muslin or light canvas thrown over this serves to exclude the excess of light. A ground-glass frame is added back of the plate-glass, which latter is removed to give place to a turn-table arrangement, made to take and hold negatives of various sizes. In practice, the ground-glass end is turned toward the strong light, the negative to be used is adjusted in the turn-table, and the image focused in the camera as usual. The 5 by 7 size largely used by horticulturists is in just the right proportion for the ordinary lantern-plate of American practice, which is $3\frac{1}{4}$ by 4 inches. Slides may also be made by contact, if the negative to be used is of suitable size. The familiar 4 by 5, $3\frac{1}{2}$ by $3\frac{1}{2}$, and $3\frac{1}{4}$ by $4\frac{1}{4}$ hand-camera films are often so used, being placed in contact with a lantern-plate in an ordinary printing-frame, and given a short exposure to an artificial light. Such slides are seldom of good quality.

If it is required to make lantern-slides from diagrams, engravings or any positive material, a negative is first prepared, for making which the vertical position of the camera-stand (Fig. 2925) is very convenient. For many diagrams and for most "reading slides," there is much advantage in making the slide directly without the intervention of a negative, with the result that the letters or lines are shown as clear glass. The audience sees only the message or object, the background being dark; and the excessive light reflection, tending to tire the eyes, is avoided.

In making lantern-slides, it is important to learn the proper exposure, for errors in exposure cannot be corrected in development to any great extent. The careful worker will expose several plates upon the same subject, give all the same development, and act upon the experience thus gained. The standard all too often accepted by those who use lantern-slides is unfortunately low. Manufacturers competing wholly on the lowest price basis have accustomed even thoughtful persons to think their productions adequate, instead of which they are unfortunate, because they belie rather than reproduce the object to be shown.

Lanterns for projecting these slides are now simple, convenient, and cheap. One form, available wherever access may be had to an electric-light socket, can be carried in a small case and set up for use in less than ten minutes. It perfectly projects an image up to 6 or 8 feet in diameter, and is without complications. Built of aluminum, it is solid and durable, and its cost is but one-fourth that of former apparatus.

Colored lantern-slides.

The value of a good lantern-slide is increased more than tenfold if the slide is so colored as to show upon the screen the object or scene in natural hues. It is not difficult, with suitable knowledge and sufficient practice, so to tint the lantern-slide as to accomplish this object, and there are a number of notably successful colorists whose work has given information and pleasure to thousands.

In practice, if a lantern-slide is to be colored, it is

usually made slightly less dense or "contrasty" than if it is to be shown without color. A photographer's retouching stand, which excludes light from the eyes of the worker and reflects light through the ground-glass and also through the slide to be colored, is needed. Coloring is effected by means of the use of dyes and stains of various characters, usually obtainable in the market. The color is applied by the use of brushes of varying sizes. The capable worker constantly compares the result of his efforts, either with standard slides of high quality or through projection upon a screen by means of a small lantern.

One reason why colored lantern-slides are so much more effective than those uncolored is in their exclusion of excessive light, which tends to dazzle and weary the eyes of the spectator, as previously suggested. Thus, a sky is blue and agreeable rather than white and dazzling.

Transparent colors must be exclusively employed, inasmuch as the effect to be obtained on the screen through projection is wholly that of transmitted light, and not by reflection.

The use of lantern-slides in general and of colored slides in particular for educational purposes has been greatly fostered by the action of several states in establishing departments of visual instruction, in which are grouped collections of carefully made lantern-slides upon various subjects, frequently available to residents of the particular states without other charge than transportation and a responsibility for damage. Pennsylvania, New York, Washington, Illinois, and Kansas are known to maintain such departments.

Motion-picture photography.

Reference has been made to the recent development of motion-picture photography. Motion-pictures are at present being viewed by many millions of persons daily in the various centers of population in the United States, but as yet little organized effort has been put forth for preparing motion-pictures primarily for educational purposes. Through the federal government, and in the Department of the Interior, the national parks are brought into notice by means of motion-picture films; and it is probable that a motion-picture outfit, both for the making of the exposures and for the proper display of the result, will shortly become an essential factor in connection with any modern educational institution. Particularly in reference to horticulture it is probable that the motion-picture will show to advantage orchard and planting operations and the growing of great crops (as before mentioned in connection with asparagus, for example), and similarly will teach quickly and entertainingly many things now less adequately presented.

Photography in natural colors.

Many investigators have worked on this problem, but without what might be called reasonable and available success, until, in 1907, the Lumière brothers, acute opticians and plate manufacturers at Lyons, France, painstakingly developed what is known as the autochrome process. This process uses the known but unappreciated fact that color is not an inherent property of matter, but a sensation of the eye relating wholly to the character of light reflected from any object. Exceedingly minute particles of nearly transparent starch, colored to three primary hues, are intermingled and spread in a single layer over the surface of a glass plate, and upon this layer there is coated a sensitive and so-called panchromatic photographic emulsion. These minute starch particles, averaging about 5,000,000 to the square inch, serve when the prepared plate is exposed glass side to the object (contrary to the usual practice) to separate or screen out the reflections from the object transmitting certain intensities relating to

the colors then expressed in that particular light. Thus, from a red rose with green leaves, light is reflected through these dots to the effect that the underlying photographic emulsion is suitably affected for the purpose in mind. After exposure there occurs a process of development and re-development which removes most of the photographic emulsion save such as marks out the delineation of the object as depicted by the lens, and as will serve to obscure the colors not wanted.

Under favorable conditions, the effect is an actual photograph in color upon a glass plate or transparency, which must be viewed as such by transmitted light suitably reflected from a white cloud or a white surface. If the light used in reflection has a differing spectrum from that used in the making of the view, the colors will not be seen as they were when the photograph was taken.

As yet no means have been devised for adequately duplicating these transparencies on glass, which, therefore, while very beautiful when properly made and viewed, serve rather as color memoranda or records than for the reproductive purpose conceived of an ordinary photograph.

In this book use has been made of the autochrome for obtaining the color records upon which the various color plates have been produced. For example, Plate VIII, Vol. I, showing the York Imperial apple, is a successful reproduction of an autochrome, as also is Plate XX, showing hardy bulbs in full color, and Plate XXV, celery, showing current commercial practice in exact color.

These autochromes are relatively expensive to make, but require only a special ray-filter in addition to the ordinary camera equipment. With autochrome plates the careful worker is able to obtain many important and delightful records.

Inasmuch as the autochrome is viewed with success only by transmitted light, it early occurred to those working in this method to propose the autochrome as a means of obtaining a perfectly colored lantern-slide. Several collections have been made which show in an exceedingly beautiful manner great scenery, portraits, and the like, but the disadvantages encountered are to the effect that inasmuch as the autochrome is much less transparent than the average lantern-slide, it cannot be shown with success in connection either with an uncolored or a colored lantern-slide. If autochrome lantern-slides are grouped together and shown in a relatively small image with a very intense light (preferably that of the electric arc only), the result is excellent.

Other methods said to accomplish color photography spring up from time to time. So far, however, not one of them has been found to be of a permanently valuable and desirable character, or in any sense equal to the autochrome, which in itself is rather inadequate.

The use of photography in relation to horticultural education and merchandising is merely in its infancy. It is probable that greatly improved methods of reproduction will permit of the more extensive and more effective use of photographs, and it seems certain that the moving-picture will assume a much greater importance in educational, philanthropic, and commercial practice. Acquaintance with photography is, therefore, likely to prove of increasing value to the horticulturist.

J. HORACE MCFARLAND.

PHOTOSYNTHESIS. Green plants exposed to sunlight at a growing temperature are able to manufacture organic food substances, that is, carbohydrates. The term photosynthesis, derived from Greek words signifying "light" and "putting together," is applied to this process of food manufacture. Green plants manufacture not only their own food carbohydrates but also are the sources of practically all of the organic matter which may eventually furnish food for both plants and

animals. It may be said, therefore, that life today is dependent upon the green leaf. The first carbon-containing compound made is a relatively simple substance, but the first recognizable material is sugar. The crude materials out of which organic substance is made in the cells of the green tissues are CO_2 (carbon dioxide) and water. The leaf green, chlorophyll, and the protoplasm of the cell may be regarded as the important mechanism, while the source of energy for the chemical change induced is radiant energy, light. Air ordinarily contains about .03 per cent of CO_2 , yet the ordinary green plant obtains all of its carbon for the making of organic matter from this extremely small quantity in the atmosphere. The chlorophyll is important inasmuch as it absorbs the radiant energy which is directly or indirectly responsible for the process. Chlorophyll is distributed within the cells in definite granules, or small bodies, protoplasmic in nature, commonly ovoidal in form. The light absorbed is largely from the red or red-orange portion of the spectrum. It is possible that the energy so derived is first transformed into electrical energy, yet little is known upon this point. It is certain, however, that green plants are unable to utilize energy derived, for example, from the absorption of heat. The process may be briefly pictured in the following manner: The cell-sap absorbs the CO_2 which diffuses into the tissues from the air. By means of the energy absorbed by the chlorophyll bodies, within the cells, the CO_2 is supposed to be reduced to CO (carbon monoxide), and the same means resolves the water into its constituents. The products of these molecular changes form new substances, perhaps formaldehyde (CH_2O) and oxygen (O_2). The formation of formaldehyde is still somewhat uncertain; but in any case sugar is soon recognized. In all probability the formaldehyde molecules are immediately condensed to sugar ($\text{C}_6\text{H}_{12}\text{O}_6$). It will be noted that the surplus oxygen is in reality a by-product and during active photosynthesis it is produced in such quantity as to be actively eliminated from the plant by diffusion. The usual test for photosynthesis is carried out by counting the bubbles given off from the cut stem of a water plant exposed to sunlight in a well-aerated vessel of spring-water. The content of oxygen in these bubbles is greater than that of normal air, and the rate of bubble-production is a fair estimate of the rate of photo-synthesis.

As a rule the sugar formed in the leaf does not accumulate to any large extent, but is transformed into starch. Some of the sugar, however, may be immediately diffused to other cells or "transported," supplying the needs of this substance in growth. The starch which is deposited is in the form of insoluble granules, and the formation of these bodies on exposure of the green leaf to sunlight is so rapid as to make it possible in some cases to use starch formation as an index to rate of photosynthesis. During the night, when no photosynthesis occurs, the transformation and removal of the starch usually goes on rapidly, so that within an interval of twelve hours most of that formed during the day seems to have disappeared from the leaf. It is, in fact, changed to sugar prior to transportation but may be removed to other organs of the plant, as, for example, to fleshy roots or tubers, where it may again be converted into starch, accumulating at times to a very considerable extent.

Photosynthesis is most rapid under those conditions of temperature which are favorable for growth. Under strong light and favorable temperature, however, a slight increase in the amount of CO_2 gives a higher rate of starch-production. The presence in the leaf or stem of other color bodies, such as browns and reds, is no indication that chlorophyll is absent. As a matter of fact, chlorophyll is generally present in such cases, but may be veiled by the more prominent color. In showy flowers, however, chlorophyll seldom occurs. Pho-

tosynthesis is inhibited by any condition affecting the general health of the plant, and it is low during cold and dark weather. The larger number of plants are most active in the brightest sunlight, but certain shade-loving species are injured by such exposures, and are adjusted to conditions of half-shade, such as obtain in the shade of trees or bushes. B. M. DUGGAR.

PHRAGMITES (Greek, *growing in hedges*, apparently from its hedge-like growth along ditches). *Gramineæ*. Large grasses, useful for planting in wet places.

Tall stout perennials with long running rootstocks, strong culms and terminal panicles with the aspect of Arundo: spikelets 3-7-flid. Differs from Arundo chiefly in having glabrous sharp-pointed not bifid lemmas, the long hairs confined to the rachilla-joints, and in that the lowest floret is staminate.—Species 3, 1 in Trop. Asia, 1 in S. Amer. and 1, our species, cosmopolitan.

communis, Trin. (*P. vulgaris*, BSP). **COMMON REED**. Culm usually 8-10 ft. high: lvs. 1-2 in. wide. Marshes and along edges of ponds. Dept. Agric., Div. Agrost., Bull. No. 20:126. Gn. 31, p. 33.—The ornamental feathery drooping panicles appear in late summer or autumn. A form with variegated lvs. is sold under the name *P. communis variegata*, or spire-reed.

A. S. ИТЧСКОК.

PHRAGMOPEDILUM (Greek, *phragmos*, a fence, alluding to the divisions of the ovary). *Orchidaceæ*. Terrestrial or epiphytic glasshouse orchids, formerly included (with Paphiopedilum) in Cypripedium.

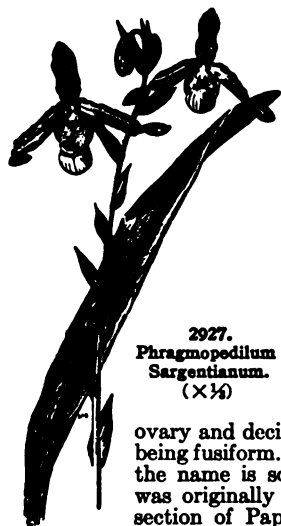
Flowers numerous, deciduous, in a raceme or panicle; sepals 3, the lateral united into one organ located beneath the lip, the other back of the column known as



2926. *Phragmopedilum Schlimii*. (×1/4)

the dorsal sepal; petals 3, the lateral similar, the other widely different, forming a pouch or sac known as the lip, the margins all around the orifice reflexed or turned in; column short; stamens 2; ovary cylindric, 3-celled, the walls thick, the ovules borne on placentæ on the divisions.—About 11 species (Pfitzer, in Engler's *Pflanzenreich*, hft. 12 [iv. 50], 1903), Trop. Amer. from Panama south. The species here considered were contained in

Selenipedium in Cyclo. Amer. Hort. The genus *Selenipedium* is still retained by botanists, however, with which *Phragmopedilum* agrees in the 3-celled ovary but from which it differs in habit, conduplicate coriaceous strap-shaped lvs., the fl. being articulated above the



2927.
Phragmopedilum
Sargentianum.
($\times \frac{1}{2}$)



2928.
Phragmopedilum
Ainsworthii. ($\times \frac{1}{2}$)
(Hybrid; see supplementary list,
page 2604)

ovary and deciduous, and the seeds being fusiform. The orthography of the name is somewhat confused. The word was originally spelled *Phragmopedilum* as a section of *Paphiopedilum*, and this form is adopted by Pfitzer and by Index Kewensis. Rolfe, the English authority, at first wrote it *Phragmipedium* and more recently *Phragmipedium*. (See discussion by him in *Orchid Review*, 9, 174, 175.)

All *phragmopedilums* enjoy plenty of heat and moisture in the growing season, March to November (65° to 90°). Give good drainage. Use chopped sphagnum with broken clinkers from the furnace, and the addition of a little leaf-mold, raising the material as high above the rim of the pot as possible. This material is especially to be recommended for the young and divided plants. Give slight shade, and grow on raised benches near the glass. Water sparingly until growth begins. The four species, *P. Dominianum*, *P. Sedenii*, *P. Schlilmii* and *P. Sargentianum*, should not be overpotted. Fill pots three-fourths full of drainage, then place a thin layer of coarse fern-root, which will fill pot to level of the rim. Place the plant on top of this and then fill 2½ to 3 inches with chopped sphagnum and leaf-mold mixed with coarse sand or pulverized coal-clinkers. Keep the moss in a growing condition. (Wm. Mathews.)

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- A. Petals similar to the dorsal sepal; stigma 3-angled-pyramidal. 1. *Schlilmii*
- AA. Petals narrower and longer than dorsal sepal.
- B. Fls. appearing successively; petals not caudate, not over twice as long as sepals.
- C. Lip without horns between sac and claw.
- D. Lvs. narrowly yellow-margined; petals linear.
- E. Scape branched, many-fl.: petals but little longer than sepals. 2. *Lindleyanum*
- EE. Scape simple, few-fl.: petals nearly twice as long as sepals. 3. *Sargentianum*

- DD. Lvs. not margined; petals narrowed from base into a twisted tail.
- EE. Sepals and ovary glabrous. 4. *caricinum*
- EE. Sepals and ovary pubescent. 5. *Klotzschianum*
- CC. Lip with 2 horns between sac and claw.
- D. Petals pendulous.
- E. Claw of lip equaling sac; horns glabrous. 6. *vittatum*
- EE. Claw longer than lip; horns pubescent on inner side. 7. *Hartwegii*
- DD. Petals divaricate or horizontal.
- E. Dorsal sepal broadly ovate, lined. 8. *longifolium*
- EE. Dorsal sepal narrowly ovate, reticulate. 9. *Boissierianum*
- BB. Fls. appearing simultaneously; petals caudate, many times longer than sepals. 10. *caudatum*

1. *Schlilmii*, Rolfe (*Cypripedium Schlilmii*, Lind. *Selenipedium Schlilmii*, Reichb. f.). Fig. 2926. Lvs. 4-6, ligulate, leathery, sharp-pointed, 9-12 in. high: scape longer than the lvs., hirsute, often branched, 2-8-fl.: sepals less than 1 in. long, ovate obtuse, the lower a little larger than the upper and concave, white or spotted with crimson on the inner side; petals like the sepals; labellum an elliptic bag with a contracted opening, white with a large crimson blotch in front; staminodium yellow. Late summer. Colombia. B.M. 5614. F.S. 18:1917. Var. *albiflorum*, Hort. Fls. white, except the yellow staminodium and a



2929. *Phragmopedilum Dominianum*. ($\times \frac{1}{2}$)
(Hybrid; supplementary list, page 2604)

suffused blotch on the labellum. I.H. 21:183. Vars. *gigantæum* and *superbum* are also advertised.

2. *Lindleyanum*, Rolfe (*Cypripedium Lindleyanum*, Schomb. *Selenipedium Lindleyanum*, Reichb. f.). Lvs. 15–20 in. long, leathery, deep green, with yellow margins; scape many-fl., pubescent, 2–4 ft. high: upper sepal ovate-oblong, undulate, light green with brownish veins; petals 2 in. long, deflexed, green with brown veins, ciliate; labellum olive-green, with brown veins and much spotted on the side lobes. Guiana. G. W. 13, p. 570.

3. *Sargentianum*, Rolfe (*Selenipedium Sargentianum*, Rolfe). Fig. 2927. Lvs. tufted, 6–8 in. long, oblong-lanceolate, acuminate, with golden margins; scape 6 in. high, 2–3-fl.: dorsal sepal oblong, acute, pale yellow with red veins; lower sepal ovate, subacute, shorter than the lip; petals longer than the sepals, strap-shaped, slightly twisted, undulate, ciliate, pale yellow streaked with red and with bright red margins; labellum yellow, with pale red veins, deflexed side lobes speckled with red. Brazil. B. M. 7446. G.C. III. 15:781. A. G. 21:423.

4. *carcinum*, Rolfe (*Cypripedium Pearcei*, Hort. C. *carcinum*, Lindl. & Paxt. *Selenipedium carcinum*, Reichb. f.). Lvs. 1 ft. long, springing in sedge-like tufts from the long creeping rhizome: scape longer than the lvs., 3–6-fl.: fls. mostly pale greenish, with the segms. bordered with white and having purple tips; sepals broadly ovate, waved, as long as the lip; petals more than twice as long, pendent, narrow, and much twisted; labellum oblong, the upper margins flat; staminodium provided with 2 hairy processes. Peru. B. M. 5466. F.S. 16:1648.

5. *Klotzschianum*, Rolfe (*Cypripedium Schomburgkianum*, Klotzsch. *Selenipedium Klotzschianum*, Reichb. f. *S. Schomburgkianum*, Debois). Lvs. linear, 6–12 in. long, scarcely $\frac{1}{2}$ in. wide, rigid, keeled: scape longer than the lvs., hirsute, purple, 2–3-fl.: dorsal sepal ovate-lanceolate, pale rose-colored, with reddish brown veins, the lower ovate, boat-shaped, colored like the upper one; petals $3\frac{1}{2}$ in. long, linear, twisted, colored like the sepal; labellum greenish yellow, the inflexed side lobes whitish, spotted. British Guiana. B. M. 7178. G.C. III. 15:625.

6. *vittatum*, Rolfe (*Cypripedium vittatum*, Vell. *Selenipedium vittatum*, Reichb. f.). Lvs. 1 ft. long, linear-ligulate, acute, margined with yellow: sts. few-fl., 12–18 in. high: dorsal sepal oblong, subacute, greenish striped with red; lower sepal about twice as broad as the upper, green; petals linear, pendent, undulate, reddish brown, striped with green and green

toward the base, longer than the sepal; labellum shorter than the sepals, brown, greenish spotted with reddish brown inside. Brazil. I.H. 23:238.

7. *Hartwegii*, Pfitz. (*Cypripedium Hartwegii*, Reichb. f. *Selenipedium Hartwegii*, Reichb. f. in part). Lvs. broadly ovate, much attenuated at apex: scape glabrous, many-fl.: dorsal sepal oblong, acute, pale green, with rosy veins and whitish margin; petals linear-ligulate, from a somewhat cordate base, velvety-glandulose on the inside toward apex, pale yellow-green with rose-pink border; lip yellowish green, tinged brown in front, the inflexed margins dotted with rose. Peru.

8. *longifolium*, Rolfe (*Selenipedium Rozei*, Reichb. f. *S. Hartwegii*, Reichb. f. in part. *Cypripedium longifolium*, Warscz. and Reichb. f. *C. Rozei*, Regel). Lvs. tufted, 8–12 in. long, narrowly strap-shaped, tapering to point, strongly keeled: scape 2 ft. high, purplish, sparingly pubescent: fls. large; upper sepals ovate-lanceolate, pale yellowish green, faintly streaked with purple; lower sepals ovate, obtuse, shorter than the lip; petals $3\frac{1}{2}$ in. long, spreading, narrowly lanceolate, twisted, pale yellow with rose-colored margins and with a white line on the edge; labellum 2 in. long, green shaded with dull purple or brown in front, side lobes yellow, spotted with pale purple. Costa Rica. B. M. 5970, 6217. I.H. 20:138. R.H. 1873, p. 416; 1893, pp. 18, 19. F.M. 1874:119. F. 1871:126.—*S. Rozei*, sometimes considered as a distinct species, is of more robust habit, having lvs. 2 ft. long and green scapes. Var. *magniflorum*, Hort. (*Cypripedium magniflorum*, Hort.), has the petals margined with white. A.F. 7:707. The following varieties also are distinguished in cult.: *grandiflorum*, *latifolium*, and *roseum*.

9. *Boissierianum*, Rolfe (*Cypripedium reticulatum*, Reichb. f. *C. Boissierianum*, Reichb. f. *Selenipedium Boissierianum*, Reichb. f.). Plant of vigorous habit: lvs. about 3 ft. long, acuminate: scape few-fl. or sometimes paniculate, 3–7-fl.: fls. of peculiar light green tints, with a few sepia-brown and green blotches on the whitish inflexed part of the lip and with some brown spots on the margins of the sepals; ovary dark brown, with green apex and ribs; upper sepals ligulate-lanceolate, very crisp; lower sepals oblong, about equal to the labellum, crisp; petals spreading, long-linear, twisted and very crisp on the margins. Peru. G.C. III. 1:143; 21:54, 55. G.F. 4:605. J.H. III. 55:51.

10. *caudatum*, Rolfe (*Cypripedium caudatum*, Lindl. C. *Lindeni*, Van Houtte. C. *Warsceviczianum*, Reichb. f. *Selenipedium caudatum*, Reichb. f.). Lvs. strap-shaped, rather stiff upright, about 1 ft. long: scape 12–24 in. high, about 4-fl.: dorsal sepals 5–6 in. long, lanceolate, pale yellow, verging on creamy white and veined with greenish, lower sepal similar; petals pendent, twisted, often attaining a length of nearly a yard, yellowish, shaded with brown on the outside and becoming brownish crimson toward the tips. Peru. F.S. 6:566. R.H. 1857, p. 318; 1883, p. 351; 1885, p. 472. G.C. II. 3:211; 26:269. Gn. 3, p. 313; 26, p. 72; 32, p. 301; 46, p. 85. A.F. 3:132; 6:859; 35:479. R.B. 24:25. Gng. 5:265. G.M. 31:557; 33:795; 35:489.—One of the largest of the genus and remarkable on account of the extremely long petals. Peloric forms with the third sepal (labellum) resembling the other two have passed under the name of *Uropedium Lindeni*, Lindl. Var. *roseum*, Hort. (*Selenipedium caudatum* var. *Warsceviczii*, Godfroy). Sepals yellow, with orange veins; petals deep purple; labellum deep yellow in front, green behind. I.H. 33:596. Var. *Wallisii*, Hort. (*Selenipedium Wallisii*, Reichb. f. *Cypripedium Wallisii*, Hort.). Lvs. paler green: fls. pale, and in every way more delicate than the type. Gn. 49, p. 140. G. 19:34. Numerous other varieties of this species are distinguished in cult. The following names occur in trade lists: *atrum*, *luxemburgense*, *rubrum*, *superbum*, *Seegerii*, *splendens*, *nigræcens*, Hort.



2930.
Phragmopedilum
Sedenii. (X $\frac{1}{5}$)
(Hybrid; supplementary list,
page 2604.)

P. Ainsworthii, Rolfe & Hurst. (Cypripedium Ainsworthii, Reicheb. f.). Fig. 2928. Hybrid between *P. longifolium* × *P. Sedenii*. Lvs. ligulate, acuminate, 1½ ft. long; scape shorter, pubescent, few-fl.; upper sepal oblong, acutish, undulate, whitish or yellowish green with a pale purple border; lower sepal very broad and concave with a reflexed margin, shorter than the lip; petal broad, purple, with a green mid-vein and a pale area near the base; side lobes of the lip yellow, with numerous spots.—*P. albobupureum*, Rolfe & Hurst. (Cypripedium albobupureum, Reicheb. f.). Selenipedium albobupureum, Reicheb. f.)= *P. Dominicanum* × *P. Schlumii*. Fls. larger than those of *P. Sedenii*; sepals oblong, acute, whitish with a purplish tinge on margins; petals 5-6 in. long, pendent, twisted, purplish, lip purplish on borders, the white infolded margin purple-spotted. Gn. 21, p. 332. J.H. III. 52:69.—*P. Brönnii*=*P. longifolium* × *P. Sedenii*.—*P. Brönnii leucoglossum*.—*P. Bryea*.—*P. Boissierianum* × *P. Sedenii*.—*P. Calurum*=*P. longifolium* × *P. Sedenii*. Fls. large, about 5 in. across petals; dorsal sepal oblong-ovate, pale green, with longitudinal purplish ribs, flushed red on outside; petals lanceolate, undulate, pale green in the center and at the base, margins rose-red; labellum oblong, rose-red tinted with brown in front; side lobes deeply inflexed, cream-white, with irregular spots of purple. G.Z. 29:241. F. 1884:145.—*P. cardinalis*, Reicheb. f. (Cypripedium cardinalis, Reicheb. f.)= *P. Schlumii* × *P. Sedenii*. Lvs. long, straight; dorsal sepal bluish-white, slightly streaked with green; petals broad, ovate-oblong, undulate, white tinged with rose-purple near the base; labellum intense purple; staminodium white. Gn. 27:520.—*P. Chlorops*=*P. caricinum* × *P. longifolium*.—*P. Cleola*=*P. Boissierianum* × *P. Schlumii*.—*P. conchiferum*=*P. caricinum* × *P. longifolium*.—*P. Coppinidnum*=*P. conchiferum* × *P. Sedenii*.—*P. Cunia*.—*P. Dominicanum*, Reicheb. f. (Cypripedium Dominicanum, Reicheb. f.)= *P. caricinum* × *P. caudatum*. Fig. 2929. Lvs. numerous, about 1 ft. long, acuminate; fls. yellowish green, with copper-brown shades and markings; labellum deep reddish brown, reticulated in front and yellowish green behind. Gn. 3, p. 491. F. 1874, p. 57.—*P. Dominicanum rubescens*=same.—*P. Gerdala*=*P. caudatum* × *P. Lindleyanum*.—*P. Gotidnum*=*P. caudatum* × *P. macrochilum*.—*P. grande* (Cypripedium grande, Reicheb. f.)= *P. caudatum* × *P. longifolium*. Lvs. dark green, over 2 ft. long; scape over 3 ft. high, with several large, shining fls.; sepal long, oblong-lanceolate, yellowish white, veined with green; petals long, pendent, yellowish green above, becoming rose-pink; labellum large, greenish yellow in front, whitish behind; side lobes white, spotted with crimson. G.M. 32:87. A.F. 11:1349. G. 27:239; 28:297. Gn.W. 4:389. Var. *abundum*. A hybrid between *P. longifolium*, *P. Roezlii* and *P. caudatum* roseum. G.C. III. 15:692.—*P. leucorrhodum*=*P. longifolium* × *P. Schlumii*. J.H. III. 47:119.—*P. macrochilum*=*P. caudatum* × *P. longifolium*. A.G. 22:763.—*P. macrochilum giganteum*=*P. caudatum* × *P. grande*. J.H. III. 53:543.—*P. Mrs. W. A. Roebling*=*P. caudatum* × *P. Sedenii*.—*P. nitidissimum*=*P. caudatum* × *P. conchiferum*.—*P. Pencans*=*P. Calurum* × *P. caudatum*.—*P. Perseus*=*P. Lindleyanum* × *P. Sedenii*.—*P. porphyreum* (Cypripedium porphyreum, Reicheb. f.)= *P. longifolium* × *P. Sedenii*. Lvs. broadly strap-shaped, acute, about 1 ft. long; fls. mostly purple, resembling those of *P. Sedenii*, but without protuberances on the open sides of the lip. The sepals and petals are oblong and more acuminate.—*P. Saundersianum*=*P. caudatum* × *P. Schlumii*.—*P. Schroederæ* (Cypripedium Schroederæ, Hort. Veitch, ex-Reicheb. f.)= *P. caudatum* × *P. Sedenii*. Plant of the habit of *P. Sedenii*, with fls. resembling those of *P. albobupureum* but larger; upper sepals nearly ochre-colored, with purple veins; lower sepals very broad, ochre-colored, with purple veins; petals long-lanceolate, undulate, pendent, 4 in. long, greenish white in the middle, crimson-purple around the margin; labellum purple outside, inflexed lobes yellow, with brown blotches.—*P. Sedenii* (Fig. 2930)=*P. longifolium* × *P. Schlumii*. Lvs. numerous, crowded, 12-18 in. long, tapering to a point; scapes 12-18 in. high, about 4-fl.; but often sending out secondary flowering branches from the axils of the bracts after the first fls. have fallen: fls. 3½-4 in. across the petals; lower sepal oval, greenish white; upper sepal oblong, acute, with faint purplish green veins; petals lanceolate, twisted, purple shading to greenish white at the base; labellum rich crimson-purple shading to paler purple behind, spotted inside. A very luxuriant free-flowering plant. F.M. 1876:206; 1878:302. R.H. 1879:470. G.Z. 21:1. O. 1910, p. 83. Var. *caudatum*, Reicheb. f. Sepals white; petals white tinged with rose; labellum darker rose. The following names are also in the trade: *grandiflorum*, *sanguineum*, *superbum*.—*P. tentillum*=*P. longifolium* magnificum × *P. Schlumii*.—*P. Titanum*=*P. Lindleyanum* × *P. longifolium*.—*P. Uranus*=*P. grande* × *P. Lindleyanum*.—*P. urandæ*=*P. Lindleyanum* × *P. longifolium*.—*P. Weidlichianum*=*P. longifolium* × *P. Schlumii*. G.M. 34:274.

GEORGE V. NASH.

PHRYMA (one of the many names which Linnæus never explained). *Phrymaceæ*. One genus and one species comprises the family. It is a hardy perennial herb of little horticultural value.

Erect, divaricately branching, with coarsely toothed ovate lvs. and small purplish or rose-colored opposite small fls. borne in long slender terminal spikes. It seems to have been rarely cult. in Eu. and offered in America by dealers in native plants. *Phryma* has been considered an outlying member of the verbenaceæ family. This is because its ovary is 1-celled, while others of the Verbenaceæ, as a rule, have a 2- or 4-celled ovary. There is some evidence for regarding it as a 2-celled

verbenaceous plant in which only half the ovary develops. This plant has the infl. of the verbenaceæ tribe and the habit of *Priva*. Ovule solitary, erect, orthotropous, laterally affixed at the base; seed without albumen; cotyledons convolute; radicle superior; stamens 4, didynamous; style slender and stigma 2-lobed.

Leptostachya, Linn. LOPSEED. Height 2-3 ft.: lvs. 3-5 in. long, thin, the lower long-stalked: fls. at first erect, soon spreading, and the calyx in fr. closed and abruptly deflexed against the axis of the spike, the teeth long, slender, and hooked at the tip. June-Aug. Common in moist and open woods, New Bruns. to Man., south to Fla. and Kans.; also E. Asia.—This very widespread and relatively unattractive plant has stimulated considerable speculation on the problem of the distribution of plants. Horticulturally, it may be worthy a place in the wild-garden for its botanical interest. The mature calices adhere to clothing, like a bur, by the hooked tips of the teeth. L. H. B.

PHRYNIUM (from Greek word for toad, because the plant inhabits marshes). *Marantaceæ*. Maranta-like plants with creeping rootstocks and large oblong showy radical leaves.

The genus is closely allied to *Calathea* and *Maranta* and is often confused with them. The Marantas are New World plants with 1 seed-bearing locule in the fruit, whereas *Calathea* and *Phrynium* have 3-seed-bearing locules, or at least a 3-celled ovary. In *Calathea*, the fl.-cluster is terminal on a leafy st. or rarely on a leafless scape arising directly from the rhizome; in *Phrynium*, the cluster is lateral from the sheathing petiole. In *Calathea* the corolla-tube is usually slender; in *Phrynium* it is usually short.—Species 14 and a few others of doubtful position are admitted to the monograph by Schumann in 1902 (Engler's *Das Pflanzenreich*, iv. 48), and other species have been described since then; they are native in India, Malasia to New Guinea.

Phryniums are grown the same as *calatheas* and *marantas* (which see). *P. variegatum*, N. E. Br., is probably a variegated form of *Maranta arundinacea*. It is a stove plant of dwarf habit with ovate-lanceolate acuminate green lf.-blades which are marked with cream-white or white stripes and bands. I.H. 33:606. F.R. 3:469. Gt. 46, p. 581. J.H. III. 28:27; 61:560. It is a worthy plant, now coming to be popular. *P. Micholitzii*, Hort. Lvs. broadly oblong, about 10 in. long, acute, green and broadly white-striped above from the midrib outward, paler beneath, midrib claret-red, petiole red. New Guinea. G.C. III. 33:suppl. April 18. R.H. 1903, p. 226. *P. floribundum*, Lem., is *Calathea violacea*, Lindl., a tall species with oblong or oblong-lanceolate lvs. green above and purplish and glaucescent beneath and violet-colored fls., from Brazil. B.R. 961. L.B.C. 12:1148. For *P. eximium*, see *Calathea eximia*. L. H. B.

PHYGELIUS (Greek, *sun flight*, because it was said to love the shade). *Scrophulariaceæ*. Small South African shrubs, hardy South and useful in greenhouses, something like pentstemon.

Plants erect, glabrous or nearly so: lvs. opposite, stalked, crenate-dentate: fls. many, long and tubular, scarlet, with exserted stamens in 2 pairs, and a long, filiform declined style; calyx 5-parted; corolla trumpet-shaped, the limb with 5 short nearly equal blunt lobes: fr. a many-seeded caps.—Species 2.

capensis, Meyer. CAPE FUCHSIA. Fig. 2931. Two to 3 ft., becoming woody at the base, glabrous, the st. with 4 angles or narrow wings: lvs. ovate to ovate-lanceolate, rounded at the base, firm and veiny, bluntly small-toothed: fls. slender, 2 in. long, somewhat curved, 2-lipped, purple-scarlet, 1-4 together on the ends of straight-spreading peduncles, drooping. Cape of Good

Hope. B.M. 4881. R.H. 1857, p. 599; 1886, p. 473. F.S. 11:1111. R.B. 25:36. G. 4:607; 35:591. Gt. 7:168. G.W. 13, p. 91.—A fine subshrub blooming in summer and hardy in protected places as far north as Philadelphia. In the N. it is known as a greenhouse plant. It is excellent for planting out, enduring heat and dry weather as well as geraniums, or even better. It is prop. by seeds and also by cuttings. The cuttings may be taken from the late autumn shoots of outdoor plants. *Phygelius* is a showy plant, deserving to be better known.

P. squillia, Harv. Infl. closer, the pedicels much shorter; calyx-segms. lanceolate or nearly oblong rather than ovate or oblong-lanceolate; corolla-tube nearly straight, about equal rather than oblique at apex; described as a handsome shrub with habit of a fuchsia. Transvaal to the eastern region of S. Afr., whereas *P. capensis* is more of the coast and central region, although reaching the Kalahari. Apparently not in cult.

L. H. B.

PHYLICA (old Greek name, now transferred to these plants). *Rhamnaceæ*. Evergreen shrubs, rarely trees: lvs. alternate, crowded, ovate, lanceolate or linear: fls. small, axillary or in dense crowded heads or spikes; calyx obconical, urceolate or cylindrical, 5-cleft, its limb persistent; petals wanting or bristle-like or cucullate; stamens 5; ovary 3-celled: fr. inferior, crowned by the permanent calyx. S. Afr. Prop. by cuttings of half-ripened shoots. *P. plumosa*, Thunb. Branches and twigs pubescent: lvs. linear-lanceolate, smooth above, tomentose beneath with revolute margins: spike oblong or roundish; bracteoles villous, twice as short as the tubular minutely pilose calyx, hairs of the tube reversed, appressed, segms. ovate-lanceolate. S. Afr. G.W. 10, p. 306. *P. ericoides*, Linn. Branches fastigiate; twigs thinly pubescent: lvs. short-petioled, spreading or erectish, linear or linear-subulate: infl. terminal heads on the rather umbellate twigs; fls. small; involucre hemispherical, its scales ovate, foliaceous, cuspidate; calyx turbinate, smooth, longer than the very villous bracteoles, segms. ovate, acute, hirsute; petals concave, cucullate: fr. a smooth caps. S. Afr. G.W. 10, pp. 305, 306.

PHYLLAGATHIS (Greek, probably alluding to the involucre head). *Melastomaceæ*. Greenhouse woody plants, with ornamental foliage and attractive flowers.

Plants with short thick sts.: lvs. opposite or the terminal solitary, large, petioled, roundish, cordate at the base, entire or denticulate, prominently nerved: fls. crowded into a short-peduncled sometimes involucre head, rosy, about $\frac{1}{2}$ in. across; petals 4, rarely 3; stamens 8, rarely 6; ovary 4-celled, rarely 3-celled: caps. top-shaped, 4-valved.—Species a half-dozen and more, Malay Archipelago and China. The lvs. of *P. rotundifolia* are praised for their colors, both above and below, their venation, their plaited character, and their strong shadows and reflected lights. The lvs. are glossy green above, tinted along the curved nerves with metallic blue and purple; beneath they are a rich coppery red, with the prominent nerves of a brighter color. For the general cult. of melastomaceous plants, consult *Melastoma* and *Medinilla*.

These are very ornamental stove perennials. Their cultural requirements from March to the end of summer call for a high temperature. From the end of February and through March the night temperature should stand at 65°; this may be gradually increased until it reaches 70° to 75° the middle of May. This high temperature should be held until the autumn, when it may be gradually reduced until the plants are held at about 60° for December and January. As the temperature is raised and the days become longer, increase the syringing, which will provide a moisture that greatly benefits this class of plants. In the spring and summer, they will require plenty of water at the roots. Give ventilation, to keep the temperature at the right mark, but not so as to cause cold drafts to strike the plants, otherwise they may be seriously injured.

In the spring and summer, the plants will need shading, but not too heavy as it will make the foliage soft. Late in autumn and winter they will stand full sun. Any renewing of the earth or compost or repotting should be done about the middle of February. A good compost to use is a fibry loam four parts, fibry peat one part, well-decayed cow-manure one part, and a moderate quantity of sand to make it open.—The plants may be increased by half-ripened wood or by

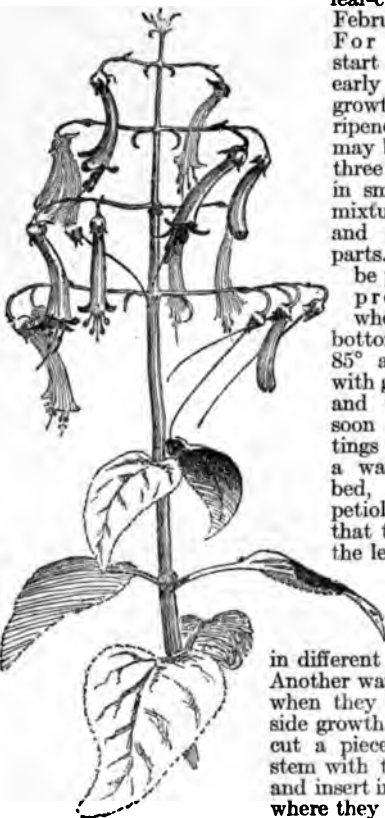
leaf-cuttings taken in February or March.

For wood cuttings, start a few old plants early and when the growth shows half-ripeness the cuttings may be taken off with three joints and placed in small pots, using a mixture of loam, peat, and sand in equal parts. These pots may

be placed in a warm propagating-bed, where they have a bottom heat of 80° to 85° and by covering with glass, kept shaded and moist, they will soon root. Leaf-cuttings may be placed in a warm propagating-bed, inserting the petiole in the sand; see that the under part of the leaf lies flat on the

sand. Keep shaded and moist and they will show growth

in different parts of the leaf. Another way to root them is when they have pushed out side growth of 2 or 3 inches, cut a piece of the woody stem with the young growth and insert in pots and plunge where they can have bottom heat. After they are rooted and potted, place them where they will get a fair amount of



2931. *Phygelius capensis*.
($\times \frac{1}{2}$)

light, and keep the atmosphere moderately humid, shading when the sun becomes too strong. Grown on by shifting until they are in 8- or 10-inch pots, they will produce good and satisfactory plants. (J. J. M. Farrell.)

rotundifolia, Blume. St. short and thick, rooting at intervals, 4-sided, dark purple: lvs. 6 in. or more by $4\frac{1}{2}$ in., roundish ovate, abruptly acuminate, denticulate, 10-ribbed lengthwise, plaited above: floral parts in 3's or 4's, in a many-fld. head: fls. reddish, subtended by dark purple scales. Sumatra. B.M. 5282.

P. gymnantha, Korth. St. short: lvs. cordate-ovate, glossy green, ciliate, 7-nerved: fls. pink, in a close head; petals lobed. Borneo.—*P. hirsuta*, Cogn. Differs in floral characters: calyx-lobes very short and broadly rounded; petals obovate and rounded; ovary adherent to calyx: lvs. cordate-ovate or broader, with 3 pairs of curving lighter-colored side veins and also banded crosswise: infl. standing higher than the handsome lvs. Borneo. I.H. 41:3.

WILHELM MILLER.

L. H. B.†

PHYLLANTHUS (Greek for leaf-flower, the flowers of some species being apparently borne on leaves). *Euphorbiaceæ*. Mostly shrubs, some herbs or trees, often cultivated in greenhouses for their graceful or curious foliage; some species have economic uses for which they are cultivated in tropical lands.

Leaves small, alternate, entire, usually 2-ranked on

the small lateral branches which then resemble pinnate lvs., such as walnut or sumach, and even fall like lvs., leaving conspicuous scars on the main branches; several species have the branches flattened into lf.-like organs with fls. and rudimentary lvs. on the margins: fls. axillary, apetalous, monœcious or dioecious, in small clusters or singly; sepals 4-6, imbricate; disk present but no rudimentary pistil in the staminate fls.; stamens 2-6 (or more), usually 3; styles slender; ovary 3-celled, 2 ovules in each cell.—About 500 species, mostly in tropical regions. Related to Breynia, Glochidion, and Securinega. Some of the species commonly cult. under the name of Phyllanthus belong more properly to Breynia or Glochidion. The genus has not been thoroughly studied since Mueller monographed it in D.C. Prod. 15, II; 274, where it is divided into 44 sections, some of which, as Emblica, Cicca, Bradleia and Xylophylla, have been considered separate genera.

Most of the species here included are grown as ornamental shrubs in the greenhouse. *P. acidus* (*P. distichus*) is often cultivated, especially in the gardens and lowlands of Jamaica and the West Indies for the fruit which is pickled or made into preserves; it is acid and astringent; the root is an active purgative and the seed is also cathartic. *P. Emblica* is also grown in the tropics for the edible fruit. *P. nivosus* is often used in greenhouses and for bedding out in summer, and in the warmer parts of Florida for permanent hedges.

In general, phyllanthus is propagated from green-wood cuttings from the larger side shoots rooted in sand in the hothouse. They are usually taken in August or before. Some leaves are left on the cutting and the sand is kept just moist but not allowed to dry. The snow-bush grows readily from root cuttings. *P. acidus* and *P. Emblica* and some other species are often grown from seeds; the latter is difficult to propagate vegetatively except by layering.

A. Branches terete or angled: lvs. well developed.

B. Lvs. not distinctly distichous, often variegated.

nivëus, Bull (*Breynia nivëa*, Small). SNOW-BUSH. Shrub of loose habit, with dark, wiry, somewhat zig-zag branches: lvs. 1-2 in. long, broadly ovate-elliptical, obtuse, white and green variegated, or sometimes all white at the tips of the branches: fls. small, greenish, hanging by long pedicels from the lf.-axils. S. Sea Isls. F.M. 1874:120. I.H. 25:332. G.Z. 18:145. Var. *röseo-pictus*, Hort. Lvs. mottled with pink and red as well as green and white. Gn. 10, p. 261. F. 1878, p. 13. Var. *atropurpureus*, Hort. (*P. purpureus*, Hort.?). Lvs. dark purple. Forms of this species are commonly planted in the tropics.

Ferdinandi, Muell. Arg. Lvs. thick, oblong-ovate, 1-1½ in. wide, 2-3 in. long, bluntly acuminate: fr. about ½ in. thick. Austral.—A good foliage shrub, hardy in S. Calif.

BB. Lvs. distichous on lateral branches, resembling pinnate lvs.

C. Stamens 6-10, filaments united, anthers not opening vertically.

grandifolius, Linn. (*P. juglandifolius*, Willd. *P. averrhoëfolius*, Hort.). Foliage branches 1-2 ft. long, leaving large scars on the thick main branches when they fall: lvs. thick, oblong-lanceolate, rounded or cordate at base, 1 in. wide, 4-5 in. long: fr. large, 3-celled. W. Indies to S. Amer.—Tall and symmetrical growing, foliage with a metallic luster; hardy in S. Calif.

CC. Stamens 2-4.

D. Sepals of staminate fls. 5-6; anthers opening vertically; filaments connate.

Emblīca, Linn. EMBLIC. MYROBOLAN. A much-branched shrub or small tree: foliage branches 3-12 in. long, with 100 or more linear-elliptical, obtuse lvs. close together and about ½ in. long: fls. small, short-

pedicelled, in the axils of the lower lvs: styles connate, caps. baccate, ¼-1 in. diam. Trop. Asia. L.B.C. 6:548.—Fr. used raw or preserved: foliage handsome, resembling fir or hemlock: lvs. and bark rich in tannin.

longifolius, Lam. Low shrub: lvs. ½-1 in. long, linear: fls. small, short-pedicelled, axillary; styles nearly free. Mascarene Isls.—Hardy in S. Calif.

DD. Sepals of staminate fls. 4; anthers not opening vertically.

acidus, Skeels (*Averrhoëa acida*, Linn. *Cicca disticha*, Linn. *P. distichus*, Muell. Arg. *P. Cicca*, Muell. Arg. OTAHEITE GOOSEBERRY. WEST INDIA GOOSEBERRY STAR GOOSEBERRY. JIMBLING. Fig. 2932. Shrub or small tree, up to 20 ft. high, main branches stout and marked by scars of fallen foliage-branches: lvs. ovate, acute, 1-2 in. long: fls. usually on separate branches below the foliage, sometimes in the lf.-axils: fr. ¼ in. long, thick, fleshy. India and Madagascar.



2932.
Phyllanthus acidus—
Otaheite gooseberry.

pulcher, Wall. (*P. pallidifolius*, Muell. Arg. *Rèidia glaucescens*, Miq.). Small shrub, foliage branches straight, with 25-40 lvs.: lvs. ½ in. long, ovate-elliptical, apiculate, pale green above, glaucous beneath: fls. small, red and yellow, drooping on pedicels 1 in. long. Malay region. B.M. 5437. G.F. 4:161. Gn. 67, p. 83.

AA. Branches flattened into lf.-like organs, with the fls. and rudimentary lvs. along their margins.

speciosus, Jacq. (*P. Arbutuscula*, Gmel. *P. latifolius*, Hort. *Xylophylla latifolia*, Sims). SEASIDE LAUREL. Small shrub: floriferous branches lanceolate, striate, crenate, ½-1 in. wide, 2-4 in. long: fls. whitish, striate, pedicels slender. Sept. Jamaica. B.M. 1021.

angustifolius, Swartz (*P. elongatus*, Steud. *Xylophylla elongata*, X. *montana*, Sims). Similar to *P. speciosus*, the floriferous branches narrower, ¼-½ in. wide, 3-6 in. long: fls. red. July. W. Indies. B.M. 2652. L.B.C. 1091.

P. acuminatus, Vahl, related to *P. distichus*. Trop. Amer.—*P. carolinensis*, Walt., an infrequent low weed from Pa., south.—*P. Chantrieri*, André, related to *P. pulcher*. Cochín-China. R.H. 1883, p. 537.—*P. epiphyllanthus*, Linn., related to *P. angustifolius*, the flat branches curved. B.R. 373.—*P. falcatus*, Swartz—*P. epiphyllanthus*.—*P. glaucescens*, HBK., related to *P. pulcher*. Trop.

Amer.—*P. isolepis*, Urban, similar to *P. speciosus*, but the flat branches tend to be rhomboid.—*P. linearis*, Swartz, related to *P. angustifolius*. W. Indies.—*P. mucronatus*, HBK.—*P. acuminatus*.—*P. Niruri*, Linn. A tropical weed with lvs. like *P. Emblica*.—*P. salviaefolius*, HBK., related to *P. pulcher*. S. Amer. R.E. 1883. p. 176.—*P. Seemannianus*, Muell. Arg. Fiji Isl.—*P. turbinatus*, Sims.—*Breynia turbinata*.—*P. seydanicus*, Muell. Arg.—*Glochidion seylanicum*, A. Juss, which is a small tree of Malaya, with coriaceous elliptic-oblong or oblong-lanceolate lvs., and depressed caps. often nearly 1 in. long.

J. B. S. NORTON.

PHYLLAUREA: *Codium*.

PHYLLITIS (Greek, *a leaf*, from the simple foliage). *Polypodiaceae*. A group of ferns, including several or only the following species, according to different fern students. Lvs. simple, strap-shaped, with the sori almost at right angles to the midrib, grouped in pairs on contiguous veins, the indusia facing together.

Scolopendrium, Newman (*Scolopendrium vulgare*, Smith. *S. officinarum*, Hort.). HART'S TONGUE. Lvs. 10–15 in. long, cordate at base or sometimes long-eared, 1–2 in. wide, herbaceous, in tufts sometimes of 50 or more lvs. Probably the rarest wild fern in Amer., growing only in three localities in Tenn. and N. Y., and near Owen Sound, Ont. Its usual habitat in Cent. N. Y. is on steep rubble limestone slopes, where it roots among loose stones, usually hidden by jewel-weed. In England it is a common wall fern, and has given rise to more than a hundred varieties, some of the commonest of which are listed below. One or two American dealers offer the species for sale. The differences between the numerous English forms depend mainly on differences in the crispiness and forking of the lvs. and on combinations of these two features. The following varieties are offered commonly in England under *Scolopendrium vulgare*: vars. *Drummondæ superba*, *crispum*, *crispum multifidum*, *crispum muricato-fimbriatum*, *ramo-cristatum*, *Dædalea*, *sagitto-grandiceps*, Hort.

R. C. BENEDICT.

PHYLLOCTATUS: *Epiphyllum*.

PHYLLOCLADUS (Greek, *leaf branch*, referring to the phyllodia which are characteristic). *Taxaceae*. Trees or shrubs: branches often whorled; branchlets flattened and expanded into rigid and coriaceous toothed or lobed lf.-like cladodia: true lvs. reduced to linear scales: fls. monœcious or dioecious, the male fls. fascicled at the tips of the branchlets, the female fls. sessile on the margins of the cladodia or on peduncle-like divisions of the same: ovuliferous scales 1 or several, thick and fleshy, free.—Six species, Malaya to the Philippines and New Zeal. *P. rhomboidalis*, L. C. Rich. (*P. asplenifolius*, Hook. f.). Tree up to 60 ft., or shrub on mountain tops: persistent branches more or less reticulate, cladodia or deciduous lf.-like branchlets cuneate or rhomboidal: lvs. very small, subulate: male catkins 2 or 3 together; female catkins globular, with 1, 2, or 3 fertile scales surmounted by 1 or 2 barren ones. Austral. Occasionally seen in Calif. gardens and eastern conservatories. The following species have also been cult.: *P. glaucus*, Carr., New Zeal., *P. hypophylla*, Hook. f., Borneo, and *P. trichomanoides*, D. Don., New Zeal.

PHYLLODOCE (after Phyllodoce, a sea-nymph mentioned by Vergil). *Ericaceae*. MOUNTAIN HEATH. Ornamental low shrubs grown for their handsome flowers.

Evergreen prostrate and ascending shrubs: lvs. alternate, crowded, linear: fls. in terminal umbels, or axillary, nodding on slender pedicels; calyx 5-parted, small; corolla urceolate or campanulate, 5-lobed; stamens 10: fr. a many-seeded caps., dehiscent into 5 valves.—Six species in arctic regions of N. Eu. and N. Asia, in N. Amer. in the Rocky Mts. south to Calif. Often united with *Bryanthus*, which is easily distinguished by its 4-cleft rotate corolla.

The mountain heaths are heath-like, with small

leaves and handsome delicate flowers often appearing in great profusion. They are perfectly hardy, but do not thrive under ordinary conditions; they are best grown in a rockery in peaty and moist soil shaded from the mid-day sun and they like cool and moist air. The hybrid *P. erecta* is more vigorous and less particular; it is therefore better known in cultivation than the true species. Propagation is by seeds in spring in peaty soil or cut sphagnum and kept moist and shady, also by cuttings in August under glass or by layers.

A. *Corolla urceolate* (urn-shaped).

cærulea, Babington (*Menziesia cærulea*, Swartz. *Bryanthus laxifolius*, Gray. *B. cæruleus*, Dipp.). To 6 in. high: lvs. slightly glandular while young, later glabrous, $\frac{1}{4}$ – $\frac{1}{2}$ in. long: fls. 2–6; calyx pubescent; corolla oblong-urceolate, $\frac{1}{2}$ in. long, glabrous, purple, turning bluish in drying. June–Aug. N. Asia, N. Eu. and boreal N. Amer. L.B.C. 2:164. S.B.F. (ed. 3) 6:886. G.W. 17, p. 261.

AA. *Corolla campanulate* (bell-shaped).

empetriformis, Don (*Bryanthus empetriformis*, Gray. *Menziesia empetriformis*, Smith). Five to 8 in.: lvs. glabrous, $\frac{1}{4}$ – $\frac{1}{2}$ in. long: fls. 6 or more; pedicels slender, glandular; calyx glabrous; corolla campanulate, rosy purple, about $\frac{1}{4}$ in. long. May–July. Brit. Col. to Calif. B.M. 3176. C.L.A. 21, No. 11:41. Var. *ambilis*, Rehd. (*P. ambilis*, Stapf). Fls. smaller, broadly campanulate, whitish or pinkish; anthers short. B.M. 8405. Var. *alba*, Hort. Fls. white. Var. *polifolia*, Hort. Taller: fls. purple.

erecta, Drude (*Bryanthus erectus*, Lindl. *Phyllothamnus erectus*, Schneid.). Hybrid between the preceding species and *Rhodothamnus Chamæcistus*. Six to 10 m.: lvs. slightly serrate, glabrous, $\frac{1}{2}$ in. long: fls. 2–10, corolla rotate-campanulate, rosy pink, $\frac{1}{2}$ in. across. F.S. 7:659. J.F. 1:58.—Originated about 1845 in the nursery of Cunningham & Fraser, at Comely Bank, Edinburgh.

P. Breweri, Heller (*Bryanthus Breweri*, Gray). Allied to *P. empetriformis*. Corolla larger, divided to the middle; stamens exserted; fls. axillary, forming terminal spikes. Calif. B.M. 8146. —*P. glanduliflorus*, Howell (*Bryanthus glanduliflorus*, Gray). Allied to *P. cærulea*. Lvs. glandular: fls. ovate-urceolate, sulfur-yellow, pubescent outside. Ore. to Alaska and Sitka.

ALFRED REHDER.

PHYLLOSTACHYS: *Bamboo*.

PHYLLOTHAMNUS: *Xanthosoma*.

PHYMATODES (Greek, *a close network*). *Polypodiaceae*. A group of stove ferns allied to *Polypodium* and sometimes united with that genus, but differing in the fine copious irregular areoles formed by the anastomosing veinlets and the free included veinlets spreading in every direction. For culture, see *Fern*.

A. *Lvs. simple*.

Swartzii, Underw. (*Polypodium Swartzii*, Baker). Lvs. 2–4 in. long, $\frac{1}{4}$ –1 in. wide, narrowed gradually toward both ends: sori in a single row each side of the midrib. Fla. Keys and Trop. Amer.

musæfolium, Blume. Lvs. 1–3 ft. long, 3–4 in. wide, with an acute point, the lower part winged to the base; main veinlets very distinct, forming rectangular meshes, with numerous small sori almost covering the whole surface. E. Indies.—Known also as *Drynaria* and *Polypodium musæfolium*.

AA. *Lvs. deeply pinnatifid*.

nigræscens, Blume (*Polypodium nigræscens*, Blume). Lvs. 2–3 ft. long, 1 ft. or more broad, cut nearly to the rachis into numerous entire lobes 1–2 in. wide; surfaces naked, dark green; sori in a single row nearer the midrib than the edge, sunk in deep cavities which are prominent as wart-like projections on the upper side. India to Polynesia.

glabrum, Kunze (*Polypodium glaucum*, Kunze). Lvs. 12–18 in. long, 6–8 in. broad, cut down to a winged rachis into entire lobes $\frac{1}{2}$ in. or more wide, both sides naked, glaucous; veinlets indistinct: sori forming a single row close to the midrib. Philippine Isls.—*Phlebodium Mayii*, Hort. (A.G. 19:455. F.E. 10:600), is a horticultural form with crinkly lvs. G.C. III. 23:328, fig. 121.

L. M. UNDERWOOD.

PHYSALIS (Greek for *bladder*, because the thin calyx enlarges and incloses the fruit). *Solanaceae*. **HUSK TOMATO. GROUND CHERRY.** Herbs of warm and temperate countries grown somewhat for the edible fruits and also for the ornament of the great colored fruiting calyx of some species.

Annual and perennial plants, sometimes lightly woody at base, straggling or diffuse in growth, glabrous or pubescent, summer-flowering: lvs. alternate (often opposite or subopposite on short shoots), mostly angled and distinctly petioled, usually soft in texture: fls. not showy, usually on axillary or extra-axillary peduncles, mostly blue or yellowish or whitish; calyx 5-toothed or -cleft, becoming large and bladder-like and inclosing the 2-celled globular yellow or greenish often more or less viscid berry; corolla rotate or short bell-shaped, usually with purplish spots in the center, plicate, short-tubed and mostly 5-toothed; stamens 5; style slender, the stigma somewhat 2-lobed. —Probably 75 species, mostly American, but a few in Eu. and Asia. The species are variable and therefore confusing to the systematist. The genus is allied to *Nicandra*, and more remotely to *Capsicum*, *Lycopersicum* and others.

Most of the species are of little consequence horticulturally, although *P. Alkekengi* and *P. Franchetii* are much prized for the glowing red very large calices, and *P. pubescens* and *P. peruviana* are grown for their edible fruits. Several of the species are known for their fruits where they grow in a wild state, and they may sometimes be transferred to gardens. In most parts of the United States and Canada one or more species grow about gardens, in fields, and in waste places. These species are popularly known as "ground cherry." The fruits are often made into preserves, although they are sometimes eaten raw. The common cultivated species are annuals, or are usually treated as such in this country. They require no extra care. The seeds are sown indoors in the North, in order to secure as much of the crop as possible before frost. Most of the



2933. *Physalis ixocarpa* in its cultivated form. (Fruits $\times \frac{1}{2}$)

cultivated species are long-season plants, and therefore need to be forwarded in the spring. The high colors of *P. Alkekengi* and *P. Franchetii* do not develop until the fruit is ripe; give a warm, sunny exposure; the plants do not withstand frost; let the plants stand 1 to 2 feet apart in the row.

A. *Plants with large red calices in fr.*

Alkekengi, Linn. **ALKEKENGI. STRAWBERRY TOMATO. WINTER CHERRY. BLADDER CHERRY.** Diffuse grower, usually with zigzag mostly simple angled setose pubescent sts.: lvs. ovate, with broad base, angular,



2934. *Physalis pubescens*. (Fruits $\times \frac{1}{2}$)

the petiole widening at the top: fls. whitish, the anthers yellow: fr. red (sometimes eaten), the ripe large calyx blood-red and very showy. Seems to be native from S. E. Eu. to Japan, but now adventive or naturalized in many parts of the world; it represents a variable group, from which different forms may be separated. Gn. 41, p. 577; 49, p. 233; 57, pp. 28, 432. —The strawberry tomato is an old garden plant, grown for its highly colored bladders. The plant grows 12–18 in. tall. Of easiest cult. In the N., plants are usually started indoors. It is a perennial, the root withstanding much frost if protected, but it is usually grown as an annual. Not hardy in the northern states.

Franchetii, Mast. (*P. Alkekengi* var. *Franchetii*, Hort.). **CHINESE LANTERN PLANT.** Differs from *P. Alkekengi* chiefly in its greater size, making a plant 2 ft. tall, glabrous, petioles shorter, and bearing calices 2 in. diam.: originally described as an annual, by others said to be sometimes biennial, but apparently perennial; probably variable in duration. Japan. G.C. III. 16:441. Gn. 48, p. 435; 49:232; 57, p. 28; 58, p. 196. G.M. 37:626. J.H. III. 29:343. R.H. 1897:376, and p. 35. R.B. 22:61; 23, p. 91. Gt. 45, p. 636; 46, p. 193. G.W. 4, p. 196. A.G. 18:81. F.R. 1:426. —One of the most profusely advertised novelties of recent years. It is a most striking and showy plant. It was brought to England from Japan by James H. Veitch, and first described with a name by Masters in 1894. In 1879, however, it had been described by Franchet, of the Jardin des Plantes, Paris, as a form of *P. Alkekengi*, but without name. The frs. are very brilliant orange-red in autumn. The berry is said to be edible. It is very likely a variant of *P. Alkekengi*. The plant called *P. Bunyardii*, Hort., is a very free-fruited form, not so robust as *P. Franchetii*, with glowing calices; probably a form of this species or by some suggested as a hybrid with *P. Alkekengi*.

AA. *Plants with green or yellow or at most only red-veined calices. Mostly grown for the edible berry.*

B. *Sts. glabrous or very nearly so.*

ixocarpa, Brot. **TOMATILLO.** Fig. 2933. Erect annual, 3 or 4 ft. tall, bearing smooth branches and lvs., the latter thin, ovate or lance-ovate and variously toothed or notched: fls. large and open ($\frac{3}{4}$ in. or more across), the border bright yellow and the throat bearing 5 black-brown spots; anthers purplish: husk or enlarged calyx purple-veined and entirely filled by the

large round, purplish sticky berry, and is sometimes torn open by it. Mex., and intro. northward to the northern states.—The form in cult., described here, is probably *P. capsicifolia*, Dun., now regarded by some as a form of the cosmopolitan *P. angulata*. The writer prefers, however, to refer the plant to *P. ixocarpa*, although there is doubt as to the identity of the cult. plant with this species. Although the cult. plant is sometimes sold as *P. edulis* (erroneously), the frs. are usually too mawkish to be eaten from the hand (at least as grown in the N.). It is a very vigorous and productive plant and is of some consequence as an ornamental, but it is too weedy to be of much value. The fr. is larger than in the native *P. angulata*. The plant figured by Carrière as *P. violacea* (R. H. 1882:216) is the one here described. In Mex., the frs. are said to be used in the making of chilli sauce and as a dressing for meats, usually under the name of "tomatoes." The Mexican forms are confused.

BB. *Sts. pubescent or hairy.*

pubescens, Linn. STRAWBERRY TOMATO of vegetable-gardens. DWARF CAPE GOOSEBERRY. HUSK TOMATO. GROUND CHERRY. Fig. 2934. Low annual, trailing flat on the ground, or sometimes ascending to the height of a foot: lvs. rather thin and nearly smooth, more or less regularly and prominently notched with blunt teeth: fls. small ($\frac{3}{8}$ in. or less long), bell-shaped, the limb or border erect and whitish yellow, the throat marked with 5 large brown spots; anthers yellow: husk smooth or nearly so, thin and paper-like, prominently 5-angled and somewhat larger than the small yellow sweetish and not glutinous fr. N. Y. to the tropics.—The plant is very prolific, and the frs. are considerably earlier than in the other species. When ripe the frs. fall, and if the season is ordinarily dry they will often keep in good condition on the ground for 3 or 4 weeks. The frs. will keep nearly all winter if put away in the husks in a dry chamber. They are sweet and pleasant, with a little acid, and they are considerably used for preserves, and sometimes for sauce. The plant is worthy a place in every home-garden. It is grown more or less by small gardeners near the large cities, and the frs. are often seen in the winter markets. The chief objection to the plant is its prostrate habit of growth, which demands much ground for its cult. In good soil it will spread 4 ft. in all directions, if not headed in. The plants are set in rows 3 or 4 ft. apart and 2 or 3 ft. apart in the row. This physalis has been long in cult. It was figured by Dillenius in 1774, in his account of the plants growing in Sherard's garden at Eltham, England. In 1781-6 it was figured by Jacquin, and by him called *Physalis barbadensis*, from the island of Barbados, whence it was supposed to have come into cult. In 1807, Martyn also described it under the name of Barbados winter cherry, or *Physalis barbadensis*, and says that it is a native of Barbados. None of these authors says anything about its culinary uses. Dunal, in 1852, described it as var. *barbadensis* of *Physalis hirsuta*, but later botanists unite Dunal's *P. hirsuta* with Linnaeus' *P. pubescens*, of which this common husk tomato is but a cult. form.

peruviana, Linn. (*P. edulis*, Sims). CAPE GOOSEBERRY. Fig. 2935. As compared with *P. pubescens*, this is a much stronger grower, the plant standing partially erect and attaining a height of $1\frac{1}{2}$ -3 ft.: lvs. thicker, less regularly toothed, more pointed, heart-shaped at the base, and very pubescent or fuzzy: fls. larger ($\frac{1}{2}$ - $\frac{5}{8}$ in. long), open-bell-shaped, the limb or border widely spreading and light yellow, the interior of throat blotched and veined with 5 purple spots, the anthers blue-purple: husk thicker and larger than in the last, somewhat hairy, and has a much longer point. Tropics. B.M. 1068. R.H. 1913, p. 85 (as var. *edulis*).—This species is too late for the northern states. The berry is yellow, not glutinous, and much like that of

P. pubescens in appearance, but it seems to be less sweet than of that species. This plant has been cult. for two centuries, probably. It was described and figured by Morison in 1715 in England. In 1725, Feuillée gave a description of its cult. in Peru, saying that it was then cult. with care and was greatly esteemed as a preserve. The particular form of the species cult. in our gardens is that described and figured by Sims in 1807 as *Physalis edulis*, the "edible physalis." Sims' account says that "this plant is a native of Peru and Chili, but is cult. at the Cape of Good Hope, in some parts of the E. Indies, and more especially at the English settlement of New



2935. *Physalis peruviana*. (Fruits $\times \frac{1}{4}$)

S. Wales, at which latter place it is known by the name of Cape gooseberry, and is the chief fr. the colonists at present possess; is eaten raw, or made into pies, puddings or preserves." The plant is rarely sold by American seedsmen.

L. H. B.

PHYSARIA (Greek, a pair of bellows, alluding to the didymous fruit and slender style). *Cruciferae*. Perennial herbs, low, canescent: sts. many and spreading: lvs. mostly entire: fls. yellow; calyx inflated, arched, net-veined; petals spatulate to oblong, entire: fr. strongly didymous with a narrow partition; cells inflated, membranaceous, nerveless, several-seeded. Four species, N. W. Amer. *P. didymocarpa*, Gray. Very canescent, about 3 in. high: radical lvs. petiolate with roundish toothed angled or entire blade or oblanceolate and more or less sinuately toothed below; cauline lvs. mostly entire, spatulate: racemes dense; fls. variable in size; sepals lanceolate, surpassed by the rather narrow pale yellow petals: fr. strongly didymous, rather deeply notched above, entire or more or less cordate at base. This species has been intro. abroad, in botanic gardens.

PHYSIANTHUS (Greek, bladder flower, referring to the base of the corolla-tube). *Asclepiadaceae*. The plants known to gardeners as Physianthus are species of Araujia, Physianthus now being referred to that genus. They are twiners with showy flowers, grown under glass or in the open in summer.

Including Physianthus and Schubertia (as is done by Bentham & Hooker), Araujia comprises a dozen or more species in the warmer parts of Amer., all with opposite lvs. and whitish or rosy fls.: corolla-tube short or long, inflated at the base; lobes 5, very wide or narrow, overlapping toward the right in the bud; crown with 5 scales attached to the middle of the tube or lower, flat and erect or convex and appressed to the staminal tube: seeds long, bearded. Schubertia and Physianthus should perhaps be considered as subgenera, the former containing the hairy plants with somewhat funnel-shaped fls.; the latter nearly glabrous plants

with somewhat salver-shaped fls. Schumann, in Engler & Prantl, separates *Schubertia* from *Araujia*, with more than half the species of the combined groups. Under this disposition, *A. graveolens* is transferred from *Araujia*. See *Schubertia*.

The species of *Araujia* resemble in superficial characters the popular *stephanotis*, having the same large white waxy fragrant 5-lobed fls. *A. graveolens*, in particular, has been suggested as a rival to the *stephanotis*, especially as it requires less winter heat, but its foliage when bruised emits a strong and offensive odor, especially with young plants. *A. sericefera* has considerably smaller fls. and is one of the several plants advertised as "cruel plants," because they entrap insects, though they may not digest their dead bodies as in the case of *nepenthes*. These "cruel plants" are mostly members of the milkweed and dogbane families, which have essentially the same kind of floral structure—a highly complicated and specialized type adapted to cross-fertilization by insects. In Fig. 398 of this work, an insect is seen struggling in the clutch of a common milkweed, with a pair of pollen-masses (a), like saddle-bags, which he may extract with one of his legs. *Araujia sericefera* catches moths in a slightly different fashion. See G.C. III. 20:523. For other "cruel plants," see *Cyananchem* and *Vincelozicum*.

When well grown, araujas or physianthus bloom freely throughout September and October. They seem to have no special soil requirements and may be flowered outdoors from seed sown indoors in early spring, or they may be kept permanently in a cool greenhouse and grown from cuttings. It is seldom that *A. graveolens* is seen grown well in greenhouses, the plants being usually sickly and infested with mealy-bug. As a summer vine in the open it makes vigorous growth, and after midsummer it usually blooms profusely. The flowers are larger than those of *stephanotis*. Cuttings make the best flowering vines. These may be taken from the ripe wood before cool weather. Seeds are freely produced, and germinate well soon after being sown. Araujias are considered hardy in the most favored parts of England, and are grown outdoors in California. *A. graveolens* can be flowered in pots, but the border of the greenhouse is better. (G. W. Oliver.)

The two species likely to be met with in cult. may be characterized as follows: *Araujia graveolens*, Mast. (*Physianthus graveolens*, Hort. *P. auricomus*, R. Graham. *Schubertia graveolens*, Lindl.) Stout, woody climber, densely covered with harsh spreading yellow hairs: lvs. 3-4½ x 2-2½ in., obovate, acuminate, greatly narrowed and cordate at the base, hairy on both sides: fls. funnel-shaped, i. e., swollen at the throat, 2-2½ in. across, umbellate. S. Brazil. B.M. 3891. B.R. 32:21. G.C. III. 4:271. See discussion under *Schubertia*.—*Araujia sericefera*, Brot. (*A. albens*, Don. *Physianthus albens*, Mart.). Name originally spelled, by Brotero, *sericefera*, in description and on plate, but usually now written *sericifera*. Nearly glabrous: lvs. 3 x 1¼ in., oblong-acuminate, wide and square at the base, minutely pubescent below: fls. salver-shaped, i. e., not swollen at the throat, pale rose in the bud and only faintly odorous, 1 in. across, cymose. S. Brazil. B.M. 3201. B.R. 1759. G.C. III. 2:653; 20:523. R.H. 1857, p. 89; 1883, p. 488. Gn. 24, p. 409; 34, p. 397. Mn. 6, p. 206. G. 6:363. The plant as above described is the *Physianthus albens* or *Araujia albens* of the trade. *A. hortorum*, Fourn., is probably a form of this species. WILHELM MILLER.

L. H. B.†

PHYSIC NUT: *Jatropha Curcas*.

PHYSOCÁRPUS (Greek, *physis*, bladder, and *karpos*, fruit; alluding to the inflated capsules). Syn., *Opulster*. *Rosaceæ*, tribe *Spirææ*. NINEBARK. Ornamental shrubs, grown for their white flowers, the attractive inflated pods and the bright green foliage.

Deciduous: bark peeling off in thin strips: lvs. alternate, petioled, stipulate, serrate and more or less lobed: fls. in umbel-like racemes; calyx-tube cup-shaped; sepals 5, valvate; petals white or rarely pinkish, spreading; stamens 20-40; pistils 1-5, more or less united at the base: follicles inflated, opening along both sutures; seeds 2-4, yellowish shining.—Thirteen species have been distinguished in N. Amer. and one in N. E. Asia. Formerly usually referred to *Spiræa*, from which it is easily distinguished by the stipulate lvs., by the inflated follicles and the long glossy seeds; sometimes united with *Neillia*, which differs chiefly in the not inflated pods dehiscent only along the ventral suture, the campanulate or tubular calyx-tube, and in the elongated inflorescence.

The ninebarks are hardy, small or medium-sized spreading or upright shrubs with usually 3-lobed leaves and with umbel-like heads of whitish or sometimes pinkish flowers appearing late in spring, and followed by clusters of small pods, inflated in some species and often assuming a bright red color late in summer. They are well adapted for shrubberies and grow in almost any soil. They propagate easily by either hardwood or greenwood cuttings, also by seeds.

A. Carpels 4-5, rarely 3.

B. Pods glabrous.

opulifolius, Maxim. (*Spiræa opulifolia*, Linn. *Opulaster opulifolius*, Kuntze. *Neillia opulifolius*, Brew. & Wats.). NINEBARK. Fig. 2936. Shrub, to 10 ft. high, with wide-spreading and recurving branches: lvs. roundish ovate, usually cordate at the base, 3-lobed, with the lobes crenately dentate, 1-3 in. long, usually glabrous beneath: corymbs 1-2 in. broad, many-fl.; pedicels and calyx glabrous or pubescent: pods 3-5, inflated, twice as long as the calyx-lobes. June. Que. to Ga., west to Man. and Kans. B.B. (ed. 2) 2:244. R.H. 1912, p. 221. Var. *lateus*, Kirchn. (var. *aureus*, Hort.). Lvs. bright yellow at first, changing to golden bronzy yellow. Var. *Debrichyanus*, Schneid.

(var. "*De Brichy*," Simon-Louis). Lvs. elongated, irregularly lobed, yellowish variegated. Var. *nanus*, Kirchn. Dwarf form with smaller, less lobed, dark green lvs.

BB. Pods tomentose.

amurënsis, Maxim. (*Spiræa amurënsis*,

Maxim. *Opulaster amurënsis*, Kuntze. *Neillia amurënsis*, Nichols.). Similar to the former, higher and of more vigorous growth: lvs. 3-5-lobed, with acute or acuminate, doubly serrate lobes, usually pubescent beneath, 2-5 in. long: fls. large, with grayish tomentose pedicels and calyx: pods only one-third longer than calyx-lobes. June. Amurland. Gt. 14:489.

2936. Ninebark.—*Physocarpus opulifolius*. (×¼)

intermedius, Schneid. (*Opulaster intermedius*, Rydb. *O. Ramaleyi*, Nelson). Shrub, to 5 ft.: lvs. orbicular in outline, 3-lobed with rounded lobes, doubly crenate, usually sparingly hairy beneath or glabrous, 1-2½ in. long: corymbs dense; pedicels and calyx finely pubescent: pods 3-5, inflated, one-third longer than the calyx-lobes. June. Ill. and Mo. to Colo. and S. D.

AA. Carpels 2, turgid, tomentose.

B. Pedicels and calyx pubescent.

bracteatus, Rehd. (*Opulaster bracteatus*, Rydb. O. *Ramdeyi*, Nelson, partly). Shrub, to 6 ft.: lvs. broadly ovate in outline, rounded or subcordate at the base, 3-lobed, doubly crenate-serrate, obtuse or acute at the apex, glabrous or nearly so, 1-3 in. long: corymbs many-fl.; bracts obovate or spatulate, often foliaceous, persistent: fls. nearly $\frac{1}{2}$ in. across, white: pods 2, united about half. June. Colo.—Plant more compact and fls. larger than in *P. opulifolius*.

BB. Pedicels and calyx glabrous or nearly so.

monogynus, Coult. (*Opulaster monogynus*, Kuntze. *Spiraea monogyna*, Torr. *Neillia Torreyi*, Wats.). Fig. 2937. To 3 ft. high: lvs. smaller, $\frac{3}{4}$ –1 $\frac{1}{2}$ in. long, incisely 3-5 lobed, with incisely serrate lobes, usually glabrous: corymbs rather few-fl.; bracts lanceolate, caducous; pedicels usually only sparingly pubescent: pods 1-2. Colo. to Calif. G.F. 2:5 (adapted in Fig. 2937).

glabratus, Rehd. (*Opulaster glabratus*, Rydb.). Shrub, 2-4 ft.: lvs. orbicular-ovate, truncate or cordate at the base, 3-5-lobed, doubly crenate-serrate, obtuse or rounded at the apex, glabrous, about 1 in. long: corymbs rather small, but numerous; bracts small, caducous: fls. about $\frac{1}{2}$ in. across, white or pink: pods 2, united to above the middle. June. Colo.—Very floriferous.

P. capitatus, Kuntze (*Spiraea capitata*, Pursh. *Opulaster capitatus*, Kuntze. S. *opulifolia* var. *mollis*, Torr. & Gray). Closely allied to *O. opulifolia*. To 20 ft.: lvs. somewhat larger, with serrate, more elongated lobes, tomentose beneath: pedicels and calyx tomentose. Ore. to Calif.—*P. malvaceus*, Kuntze (*Neillia malvacea*, Greene. *Opulaster pubescens*, Rydb. *Spiraea pauciflora*, Nutt.). To 5 ft.: lvs. slightly 3-lobed, with crenately and obtusely toothed lobes, usually pubescent: corymbs rather few-fl.; pods 2-3, not inflated, tomentose, about as long as sepals. Wyo., Idaho. B.M. 7758 (as *Neillia Torreyi*).

ALFRED REHDER.

PHYSOCHLAINA (Greek, *bladder, outer garment*, having reference to the inflated calyx). Also spelled *Physochlæna*. *Solanaceæ*. Erect, nearly glabrous herbs: lvs. petioled, subentire: infl. a terminal corymb; calyx campanulate, lobes 5, short, elongated in fr., overtopping the caps; corolla elongate, lobes 5, short-imbricate in bud; stamens attached at the middle of the tube; ovary 2-celled: fr. a 2-celled caps.—About 5 species. Cent. Asia. *P. prædita*, Hook. (*P. grandiflora*, Hook.). Perennial: sts. 2-4 ft., corymbose upward: lvs. 4-6 in. long, 3 in. broad, irregular, base cuneate or cordate on the same branch: fls. all pedicelled; calyx-lobes lanceolate; corolla tubular-funnel-shaped or sometimes shorter-funnel-shaped in wild examples, in cult. examples wider sub-campanulate: fr. a caps. $\frac{1}{2}$ in. diam. Himalaya region. B.M. 4600.

PHYSOPTYCHIS (Greek, *bladder fold*). *Cruciferae*. Perennial plant, felty with stellate hairs: fls. yellow, short-peduncled; calyx not saccate: fr. spherical, valves net-veined; seeds without wings. Formerly included in *Vesicaria*, but now separated chiefly by the mem-

branaceous not crustaceous 'siliques.—One species, Persia. *P. gnaphalodes*, Boiss. (*Vesicaria gnaphalodes*, Boiss.). Half shrub: sts. simple with basal lvs.: lvs. elliptic-lanceolate, obtuse, with prominent nerves below: fr. a short silique with deciduous style, 4-celled. Persia. A small alpine plant which in general appearance resembles an *aubrietia*, but its foliage is grayer and its fls. are of a bright citron-yellow color. Sparingly in cult. in Eu.

PHYSOSIPHON (Greek, *bladder tube*). *Orchidaceæ*. Tufted epiphytes: sts. in the form of creeping rhizomes, at the end 1-lvd., 1-2 sheaths below the lf., not pseudobulbous: lf. coriaceous, narrow at base: infl. an elongated raceme; fls. small, short-pedicelled, secund; sepals joined at the base in an ovoid or urceolate tube, above free, spreading; petals dwarfed in the base of the tube, fleshy, obovate-cuneate; labellum small, articulate with the base of the column, oblong-cuneate, concave, midlobe shortly exceeding the others; column below elevated, footless or produced in a short foot, clinandrium short, often obtuse, 3-lobed; anthers terminal, deciduous, pollinia 2, waxy, ovoid. About 15 species, Mex. to Brazil. *P. Loddigestii*, Lindl. Lf.-stalks 1-2 in. high, sheathed with a brown membrane: lvs. fleshy, about 4 in. high: scapes erect, 6-9 in. high, 12-15-fl., produced from the junction of the lf.-stalk and blade; scapes are produced by the same lf. in successive years: fls. small, petals and lip minute, hidden in a green, 3-sided tube formed by the connate bases of the sepals, free part of sepals orange-brown. Mex. J.H. III. 48:71. A coolhouse orchid sometimes offered in trade-lists. *P. asaroides*, Kränzl. Rhizome long and slender: sts. very short, almost none: lvs. 3-cornered, thick, lanceolate, up to 1 $\frac{1}{4}$ in. long, usually reddish: fls. solitary or in pairs, very shortly stalked, green-spotted and suffused with purple outside, dark purple inside; tube of sepals 1 in. long; petals and lip 1-1 $\frac{1}{2}$ in. long. S. Brazil. Said to be in cult. in Eu.

F. TRACY HUBBARD.

PHYSOSTEGIA (Greek, *bladder and covering*, referring to the inflated fruiting calyx). *Labiatae*. FALSE DRAGON-HEAD. Hardy herbaceous perennials, native to America, with spikes of gaping flowers of purple, rose-color, or white; useful in borders and particularly in wild-gardens.

Smooth erect herbs with slender and wand-like sts.: lvs. opposite, sessile, mostly lanceolate or oblong and usually serrate or dentate: fls. showy, pink to purple and varying to white, in separate or panicle spikes; calyx bell-shaped, swollen and remaining open in fr., membranous, 10-nerved; teeth 5, equal; corolla 2-lipped, inflated above; upper lip concave, rounded, entire or nearly so; lower lip 3-lobed, the middle lobe commonly notched; stamens 4, didynamous; anther-cells parallel.—A few species, N. Amer., mostly along stream banks and in wet grounds, but thriving under good upland garden conditions; sometimes named under *Dracoccephalum*. *P. austriaca* of lists is probably *Dracoccephalum austriacum*.

virginiana, Benth. (*P. virginica*, Hort. *Dracoccephalum virginianum*, Linn.). Sts. mostly simple, to 4 ft., producing large clumps in. cult.: lvs. lanceolate, oblong-lanceolate to linear-lanceolate, 3-5 in. long, finely or rather coarsely serrate, the lvs. prominent up to the infl.: fls. an inch long, ranging from purplish red through rosy pink and lilac. Que., west and south. B.M. 467. Mn. 7:81. F.R. 5:55. Gn.M. 1:121. F.E. 15:322. Var. *alba*, Hort., is a white-fl. form. R.H. 1898:336. G.W. 7, p. 458. Var. *speciosa*, Gray, is a tall form with very acutely serrate lanceolate lvs. and dense-panicled spikes. A Texan form with erect, imbricated fls. B.M. 3386 (*P. imbricata*). Var. *gigantea*, Hort., is advertised as a giant form, 6-7 ft. tall, with large deep rose fls. *P. virginiana* is a hardy vigorous plant of the easiest



2937. *Physocarpus monogynus*. (× $\frac{3}{4}$)

cult., blooming in midsummer and later. The clumps are frequently divided.

denticulata, Brit. (var. *denticulata*, Gray. *Dracocéphalum denticulatum*, Ait.). A lower and more slender plant with crenulate denticulate or obscurely serrate lvs. and more slender or loosely fld. spikes: lvs. few near the inf., so that the latter is as if long-peduncled. Pa. to Ill. and far south. B.M. 214.

WILHELM MILLER.
L. H. B.†

PHYSOSTÉLMA (Greek, *bladder girdle*, referring to the shape of the scales of the crown). *Asclepiadaceæ*. Twining glabrous shrubs: lvs. opposite, leathery, shining; fls. large, umbelled; sepals small, narrow; corolla cup-shaped, lobes very short; coronal processes 5, very large, ovoid-oblong, obtuse, adnate to the anthers; column tips inappendiculate: fr. long, smooth follicles; seeds comose.—About 5 species, India, Malaya.

Wállichii, Wight (*Hoya campanulata*, Blume). Lvs. 3–5 in. long, elliptic-oblong, acuminate; nerves reticulate; petiole $\frac{1}{4}$ in. long; cymes globose, 3–4 in. diam.; peduncle stout; corolla pale yellow, lobes apiculate. India, Malaya. B.M. 4545. J.H. III. 49:461. J.F. 1:70.—Cult. in Great Britain. The treatment given to hoyas is suitable for this plant.

PHYSŪRUS (Greek, *bladder and tail*; from the purse or pouch-like spur). *Orchidaceæ*. Of the type of *Goodyera* and *Anoctochilus*, and cultivated for the foliage. By late authors, the name *Erythrodus* is used for these orchids for nomenclatorial and botanical reasons.

Stem simple, erect, leafy: lvs. petiolate, ovate to lanceolate: fls. small, in a terminal raceme; petals and dorsal sepals cohering, galeate; lateral sepals free; labellum spurred, strongly concave above the entrance of the spur and abruptly contracted, middle lobe spreading or recurved; column short.—About 40 species, native of the warm regions of Asia and Amer. The American species have their lvs. mostly spotted.

querceticola, Lindl. (*Goodyera quercicola*, Chapm.). St. ascending, 6–12 in. high: lvs. ovate or oblong-ovate, thin, on slender petioles, spotted with silver-gray; spike densely fld.; sepals and petals oblong, obtuse; labellum concave, ending in a broadly ovate, acuminate and recurved point; spur pouch-like. Aug. Low shady woods, Fla. and westward. Under the new nomenclature this species becomes *Erythrodus querceticola*, Ames.

P. viduus, Rolfe. Lvs. elliptic-lanceolate, about 5 in. long; scape stout, bearing an elongated dense spike about 6 in. long: fls. small, whitish. Peru.

HEINRICH HASSELBRING.

PHYTÉLEPHAS (Greek, *elephant plant*; referring to the hard white seeds which can be worked like ivory). *Palmaceæ*. Low unarmed pinnate palms.

Stems stout, erect or prostrate and rooting: lvs. terminal, elongate, pinnatisect; segms. numerous, the upper opposite, the lower alternate or fascicled, linear-lanceolate, acuminate, midrib strong; spadices peduncled, scaled, male pendulous, female erect; spathes 2, complete, elongate: fls. dioecious; male minute, perianth lacking, stamens numerous; female very large, sepals 3, petals 5–10, 2–3 in. long, rather fleshy, staminoids many, ovary subglobose: fr. a collection of 4–6 drupes, forming a large cluster.—About 15 species, S. Amer.

macrocarpa, Ruiz & Pav. **IVORY-NUT PALM**. Caudex about 6 ft. high, creeping, rooting: lvs. 15–20 ft. long, erect, beautifully arched, pinnate, rich dark green; the pinnæ very long. Colombia and Venezuela. B.M. 4913, 4914. Gn. 24, p. 468. G.M. 57:9.—This species furnishes the "vegetable ivory" of commerce. Sometimes known as "negro's head."

F. TRACY HUBBARD.

PHYTEŪMA (old Greek name, meaning simply "a plant," used by Dioscorides for some mignonette-like herb). *Campanulaceæ*. **HORNED RAMFION**. Hardy herbaceous perennials, used for borders and alpine

gardens; not much known in this country except by fanciers and those who grow rock-garden plants and alpenes.

Low or tall, with st.-lvs. alternate, and radical lvs. larger and long-petioled, sometimes very narrow and grass-like: fls. mostly blue or purplish, varying to white, usually in dense terminal heads or spikes, sometimes somewhat umbellate, the fl.-bud long and curved; corolla opening more or less with 5 very narrow segms.



2938. *Phyteuma comosum*. A tufted alpine plant growing in a crevice. ($\times \frac{1}{2}$)

(sometimes remaining closed); stamens 5, free from corolla, filaments more or less dilated at base, anthers free and distinct; styles 2–3-cleft, often protruding, the lobes very narrow: fr. a caps. crowned by the calyx-teeth, laterally dehiscent.—Species about 40, Eu. and adjacent Asia, mostly in the mountains, sometimes at great elevations.

The flowers in *phyteuma* are mostly shades of blue, more or less purple, rarely white. There are two forms of inflorescence, the globular and the long-and-narrow, the former being the more interesting. The showy feature of *P. comosum*, at first glance, seems to be a group of colored and much elongated pistils; but these pistil-like bodies are really corollas which usually show alits at their inflated base and are narrowed above into a very slender tube from which the style and stigmas are much exerted. In this species the corolla does not open, but in the others it finally splits at the top, making a spreading or wheel-shaped flower. The plants usually seed freely and may also be propagated by division, which is best performed in spring after growth begins. They thrive in ordinary garden soil in either rock-garden or border. In an account of the cultivated species, Correvon (Gn. 63, pp. 39–41, 58) distinguishes three cultural groups: (1) the mural or wall species, comprising only *P. comosum*; (2) the rock-loving species, comprising *P. Carestia*, *P. Charmelii*, *P. confusum*, *P. globulariaefolium*, *P. hemisphaericum*, *P. humile*, *P. pauciflorum*, *P. serratum*, *P. Sieberi*, *P. Scheuchzeri*; (3) the open-ground species, as *P. austriacum*, *P. betonicaefolium*, *P. canescens*, *P. Halleri*, *P. limonifolium*, *P. Michellii*, *P. orbiculare*, *P. scorzonifolium*, *P. spicatum*. The rock-loving species (2) require rock fissures in full sun, without damp, little soil and that only of leaf-mold and sand. The open-ground species (3) are those of woods and pastures and are easy to grow in gardens.

The botanical account following is mainly derived from DC. Prod. 7:450 and Koch, Syn., Flor. Germ., with considerable additions in descriptions from Correvon. There is likely to be some confusion in the species and the forms known in cultivation.

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A. Infl. a raceme or panicle.

1. *canescens*, Waldst. & Kit. Scabrous, grayish green: st. unbranched: lvs. sessile; lower ones ovate, crenate-serrate, narrowed at base; upper ones nearly entire: fls. blue, short-peduncled, solitary, sparse. Hungary, Caucasus.—The plant described by Correvon under this name is said to have fls. in close spikes.

AA. Infl. a compact umbel.

2. *comosum*, Linn. Fig. 2938. The only species in the genus with umbellate infl., and in which the corollas are not finally split at the apex. A decumbent unbranched glabrous plant, 3-6 in. high, native to the Alps: fls. pale lilac below, darker purple above: roots thick and fleshy, stoutly lodged in the fissures of rocks: lvs. cordate-ovate or those on the st. lanceolate, coarsely toothed: the 2-lobed styles are long-protruded. B.M. 6478. G.C. II. 14:177. Gn. 18, p. 245, copied in Gn. 28, p. 91; 44, p. 554, and R.H. 1882, p. 452. Gn. 63, p. 39. J.H. III. 52:364. G.W. 8, p. 597. G.C. II. 26:81, copied in I.H. 34:11.—Said by Correvon to demand a fissure in a wall or face of lime-rock. A handsome species.

AAA. Infl. a spike or head.

B. Fruiting spikes long and narrow, cylindrical.

c. Flowering spikes roundish or oval.

D. Stigmas 2.

3. *scorzonerifolium*, Vill. Fig. 2939. This and *P. betonicaefolium* should probably be regarded as botanical varieties of *P. Michellii*, but for clearness and for horticultural purposes they may be considered as distinct species. A native of the Alps with long-spiked fls. of sky-blue (B.M. 2066, erroneously as *P. betonicaefolium*) or purplish blue (B.M. 2271): lvs. polymorphous.

4. *Michellii*, All. This may also be distinguished from *P. scorzonerifolium* and *P. betonicaefolium* by having the calyx pilose at the middle, it being glabrous in the other two. A native of Mt. Cenis in Sardinia, with lvs. ovate-lanceolate or narrow, not cordate: color of fls. deep blue, in lengthening spikes.

DD. Stigmas 3.

5. *betonicaefolium*, Vill. Rather tall: root-lvs. cordate-lanceolate, long-stalked: bracts fewer than in *P. Michellii* and probably not reflexed: spikes lengthening toward end of season, on st. nearly 20 in. high: fls. blue. Eu. Not B.M. 2066, which is *P. scorzonerifolium*. Gn. 63, p. 57.

cc. Flowering spikes oblong or nearly so.

D. Spikes dense.

6. *spicatum*, Linn. Woodland plant: lvs. ovate-elliptical, serrate, often brown-blotched at base, the lower ones long-stalked and cordate: fls. in a close spike, white or blue, greenish at tips. Eu. B.M. 2347. Gn. 63, p. 57. G.W. 8, p. 596.

7. *Halleri*, All. Tall and stout: lvs. ovate-orbicular, doubly and coarsely serrate, long-stalked: fl.-st. 2-2½ ft.; spike ovoid-oblong, long and close subtended by 2 long drooping bracts: fls. dark violet to white. Mountains in Eu. Gn. 63, p. 58.

DD. Spikes loose.

8. *limonifolium*, Sibth. & Smith. Fig. 2939. Tall, fl.-st. 20-28 in. high and branching: fls. light blue, open, in a long narrow spike: this may be distinguished by

the st.-lvs., which are few and pass into bracts; radical lvs. lanceolate, long-petioled, sparingly toothed. Asia Minor. B.M. 2145 (as *P. stricta*). L.B.C. 7:667 (as *P. virgata*).

BB. Fruiting spikes little elongated, merely oval.

c. Number of fls. about 5.

9. *pauciflorum*, Linn. Very dwarf, said by Correvon to be the smallest and most tufted of the genus, about 3 in. high: lvs. entire or toothed at obtuse tip; root-lvs. short, obovate-lanceolate: bracts ciliate, entire or subdentate at base, never dentate at apex: fls. few in heads with ovate-orbicular bracts, violet-blue. W. Alps, Carpathians and Pyrenees. Gn. 63, p. 40.

cc. Number of fls. about 12.

10. *globulariaefolium*, Sternb. & Hoppe. Probably a variety of *P. pauciflorum* with larger sts. and lvs. widened in the upper part and toothed, and by more globular heads: root-lvs. 2-4 lines longer and thrice as wide, and the bracts always entire at the base: fls. violet. Austrian Alps..



2939. *Phyteuma limonifolium* and *P. scorzonerifolium*, showing loose-spiked and dense-spiked forms of inflorescence.

11. *hemisphaericum*, Linn. Small plant with grass-like foliage, forming large tufts: lvs. erect; root-lvs. subentire, linear or lanceolate-linear, much or little shorter than the st.: bracts ciliate, subentire, ovate-lanceolate: fls. blue, white or yellowish. Granitic Alps.

12. *humile*, Schleich. Root-lvs. linear-lanceolate, narrowed at the base, upper ones remotely denticulate, larger than those of *P. hemisphaericum*: bracts narrowly lanceolate from an ovate base, sharply toothed: fls.

violet-blue, in globular heads. High Alps.—*P. Caréstiae*, Biroli, is a thick-set form of *P. humile*. Probably *P. serratum* is also a form of this species with larger st., somewhat wider lvs., and calyx glabrous rather than minutely ciliate. Gn. 28:90; 63, p. 40.

13. *Sièberi*, Spreng. (*P. Charméliei*, Sieb., not Vill.). Lvs. cordate, ovate or ovate-lanceolate to ovate-orbicular, crenate: bracts ovate, acuminate, sharply serrate: fls. deep violet-blue, in globular heads. S. Alps and Apennines.

ccc. Number of fls. 15 or more.

14. *orbiculare*, Linn. (*P. confusum*, Kerner. *P. austriacum*, Beck). Rootstock mostly thick, the sts. simple and usually erect, $\frac{1}{2}$ –2 ft. tall: lvs. crenate; root-lvs. cordate or ovate; upper st.-lvs. linear: bracts subserrate, spreading or reflexed: fls. purple. Eu. B.M. 1466 (as *P. cordata*). L.B.C. 2:122.—A very variable species, and widely distributed, from England to mountain pastures on the continent. Correvon keeps *P. austriacum* distinct, the basal lvs. having blades longer than petioles, upper lvs. ovate-lanceolate, and specially by the erect fl.-bracts; also *P. confusum*, from granitic rocks of the Tyrol, which seems from his description to be a very different plant, with long and grass-like lvs. and deep violet fls.

15. *Charméliei*, Vill., not Sieb. Rootstock thick and brittle: sts. 6–12 in.: lvs. soft and coarsely serrate: bracts linear-lanceolate: fls. dark blue, in globular heads. Probably a botanical variety of *P. Scheuchzeri*. Alps. Here probably belongs the cut-lvd. *P. comosum* in Gn. 19, p. 419; 44, p. 554; and *P. orbiculare*, Gn. 28, p. 90.

16. *Scheuchzeri*, All. Sts. slender and flexile, 4–16 in. tall: lvs. ovate-elliptical, serrate, the upper ones long and narrow: bracts 18–24 lines long, reflexed or spreading: fls. deep violet-blue, in rounded heads, the bracts exceeding the head. S. Eu., in mountains. B.M. 1797. Gn. 63, p. 40.

WILHELM MILLER.
L. H. B.†

PHYTOLACCA (a hybrid name: Greek, *phytos*, plant, and French *lac*, or Italian *lacca*, lake; referring to the crimson berries). *Phytolaccaceae*. Ornamental herbs and woody plants; some of them yield edible parts of minor value.

Shrubs, herbs, or trees, sometimes climbers, with angled or subterete branches, glabrous or nearly so: lvs. alternate, sessile or mostly petiolate, acute or obtuse, entire; stipules none: fls. small, borne in erect or nodding racemes on spikes which are at first terminal but by further growth of the st. may come opposite the lvs.; calyx of 4 or 5 persistent rounded sepals; stamens about 5–30; ovary of 5–16 distinct or connate carpels: fr. a fleshy berry; seeds 1 in each cell.—Twenty-six species as defined by Walter in Engler's *Das Pflanzenreich*, hft. 39 (IV. 83), published in 1909, distributed in tropical and subtropical regions, mostly in Amer., and a few in Asia and Afr., one species extending to Canada. They are plants of simple requirements in the regions where they grow, and are prop. readily by seeds. *P. dioica* is a very useful tree for ornament and shade in S. Calif. The common pokeweed (*P. americana*) is a familiar wild plant in E. N. Amer.; it is a plant of good habit, vigorous growth, and ornamental berries, and is sometimes placed in back borders and wild-gardens. Related genera in cult. are *Ercilla*, *Rivina*, *Agdestis*.

A. Stamens and carpels 10.

americana, Linn. (*P. decandra*, Linn.). **POKE**. **SCOKE**. **GARGET**. Tall stout bushy perennial herb, reaching 10–12 ft. high, the sts. soft or semi-succulent and smooth, glaucous, and the maturer parts purple-tinged: lvs. oval-oblong or oblong-lanceolate, gradually narrowed both ways, acuminate, the petiole more or less mar-

gined: fls. purplish or greenish white, in peduncled simple racemes and borne on stout bracted pedicels; ovary 10-carpelled and green, ripening into a wine-purple berry. Maine through Ont. to Minn., and far southward; naturalized in Eu.; often a weed, particularly in clearings and new lands. B.M. 931. Gn. 21, p. 179. G. 7:667. Mn. 1, p. 53.—A robust plant with heavy odor, but of good habit and clean. This species, the common pokeberry, is offered by dealers in native plants and its young asparagus-like shoots are sometimes used as a pot-herb. Its flattish berries yield a crimson juice of a very distinct hue, but it has never been fixed for dyeing purposes. Children sometimes make red ink from the berries for amusement. The berries have been used to give color to pale wines, but its use for this purpose is injurious and in Portugal has been prohibited by royal decree. The roots are emetic, purgative, and somewhat narcotic. The word "poke" is supposed to come from the American Indian word *pocan*, which apparently referred to any plant yielding a red or yellow dye, as pokeweed or bloodroot. In President Polk's campaign his followers wore lvs. of pokeweed. In collecting young shoots for greens, care must be taken not to include any portion of the root, as this would give a bitter taste and might cause serious illness, as the roots contain powerful drastic principles. Small pieces of the root eaten by mistake for horse-radish or turnip are reported to have caused serious and in some instances fatal cases of poisoning. The seeds are also poisonous. Directions are given in some of the older writings for the cult. of poke for the young shoots, which are eaten early in the season as a substitute for asparagus; but the wealth of other pot-herbs renders this plant unnecessary. It may be increased by seeds or by division of the thick roots. A variegated form once cult. for ornament is shown in R.H. 1887, p. 16, the lvs. light green above often shaded rose and more or less margined white, beneath pale rose to violet.

AA. Stamens and carpels less than 10, usually 8.

esculenta, Van Houtte (*Pircunia esculenta*, Moq. *Phytolacca Kaempferi*, Gray. *P. pekinensis*, Hance). Somewhat woody, suberect, the sts. thick, green and glabrous: lvs. short-petioled, broad-elliptic or ovate, the apex somewhat acute or blunt: infl. suberect, loosely racemose, not surpassing the lvs., the peduncle and rachis glabrous: fls. pedicellate; calyx white, the parts rounded; stamens commonly 8, with white filaments and rose-colored anthers; style recurved: fr. with 8 free carpels. China, Japan.—Cult. for the edible lvs. This name is catalogued in England as "American grape."

acínosa, Roxbg. Much like the last: peduncles and rachis scabrous: filaments and anthers white; style suberect; calyx-parts green at middle, white on margin, apex acute: lvs. ovate-oblong, acuminate at apex. China and Japan; spontaneous in India and said to be cult. for its lvs. which are edible when cooked.

AAA. Stamens 20–30; carpels 7–10; fls. dioecious.

dioica, Linn. (*Pircunia dioica*, Moq. *Phytolacca populifolia*, Salisb. *P. arborea*, Hort.). Evergreen tree, attaining great thickness of trunk and spread of top: branchlets glabrous: lvs. slender-petioled, glabrous, elliptic or ovate, mostly broadly acute at apex, the mid-nerve extending at the tip: infl. racemose, scarcely surpassing the lvs., suberect or pendulous: male fls. with 20–30 stamens, and calyx-parts elliptic and obtuse, white-spotted; female fls. with about 10 staminodia, the calyx parts broad, the ovary globose and 7–10-carpelled: fr. berry-like, the carpels connate at base and free at top. S. Amer., the "umbú" and "bella sombra" of Spanish-speaking people.—This species was intro. into Santa Barbara some 40 years ago, and is now well distributed in S. Calif.; there are trees with spread of top of 50 ft. and trunk 6 ft. diam., with buttresses 2 ft. high. It is a tree of astonishingly rapid growth, soon

making a good shade. In a recent freeze, it is reported that trees have lost their lvs. but the growth remained uninjured.

L. H. B.†

PIARANTHUS in part: *Caralluma*.

PICEA (ancient Latin name derived from *piz*, pitch). *Pinææ*. SPRUCE. Ornamental trees, grown for their evergreen foliage and regular pyramidal habit; many species are valuable timber trees.

Evergreen trees with usually whorled spreading branches: lvs. usually 4-angled with white lines formed by numerous stomata arranged in rows and on all 4 sides, or compressed and stomatiferous only on the upper or ventral side which, on the lateral branchlets, by twisting of the lf.-stalk appears to be the lower one, sessile and jointed at the base to a short stalk projected from a prominent cushion called a pulvinus: fls. monocious, catkin-like, terminal or axillary; the staminate yellow or red, consisting of numerous spirally arranged anthers with the connective enlarged at the apex and scale-like; the pistillate greenish or purple, consisting of spirally arranged scales each subtended at the base by a small bract and bearing 2 ovules at the inner side: cones pendulous or spreading, with persistent scales not separating from the axis after shedding the seeds, which are provided with a large and thin obovate or oblong wing.—Thirty-eight species in the colder and temperate climates of the northern hemisphere from the arctic circle to the high mountains of the temperate regions. They are all mentioned below and all of them except 4 are in cult. The names *Picea* and *Abies* are often exactly transposed by horticulturists and others.

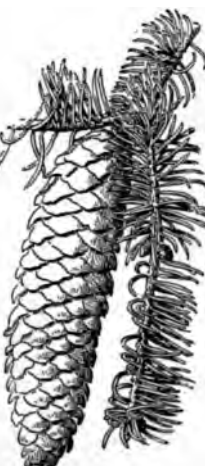
The spruces are usually tall trees of pyramidal habit, sometimes dwarfed in horticultural varieties or in alpine forms, with spreading usually whorled branches clothed densely with acicular spirally arranged leaves. The catkin-like flowers appear in spring and are often very conspicuous by their bright red color. These are followed by usually pendent cones, green or purple before ripening and light to dark brown at maturity. The spruces are not only highly ornamental, but also very valuable forest trees, and as inhabitants of cooler climates they are especially adapted for cultivation in northern regions. Almost all are hardy North, except *P. sitchensis*, *P. Smithiana* and *P. spinulosa*, but they do not resist heat and drought well; some, however, as *P. pungens*, *P. canadensis*, *P. Omorika*, *P. orientalis*, *P. excelsa*, and some of the recently introduced Chinese species grow better in a drier climate than most others. For ornamental park planting the spruces belong to the most valuable evergreens on account of the symmetrical habit and rapid growth of most species. Only a few, like *P. orientalis*, *P. obovata*, *P. Omorika*, and *P. polita*, are of slower growth and therefore well suited for smaller parks and gardens; and so are the numerous horticultural forms, which are mostly dwarf and slow-growing and sometimes more interesting and curious than beautiful. The spruces are often planted as shelters and windbreaks, and also used for hedges, especially *P. excelsa*, which makes a very dense and durable hedge when regularly trimmed. *P. polita* is also recommended as a good hedge plant and seems well adapted, with its rigid spiny leaves. The spruces thrive best in moderately moist sandy loam, but will grow in almost any kind of soil provided it contains enough moisture; wet and dry soils are equally unfavorable. Slopes of northern aspect are well suited for spruces, and they thrive better in shady positions than most other conifers. As the roots mostly spread horizontally near the surface, the spruces will grow in shallow soil and are easily transplanted even as rather large plants; they may be moved with success at any time of the year except when the young shoots are growing, but if possible avoid transplanting shortly before dry weather is expected to set in.

Spruces are propagated by seeds, which ripen in fall and are usually kept dry and cool during the winter and sown in spring outdoors in prepared beds or in frames or boxes. The young seedlings should be shaded and watered in dry weather and may remain a year or two before being transplanted in nursery rows when not sown too thickly. Varieties and rarer kinds are often increased by layers or by grafting on seedling stock of *P. excelsa*. *P. canadensis* is used for forms of this species and for *P. mariana* and *P. rubra*. Veneer-grafting in spring or August in the greenhouse is usually employed; less commonly cleft-grafting with half-hardened wood. The dwarf forms grow readily from cuttings under glass in August or fall and given slight bottom heat in early spring; also most other forms and species, especially those with thinner and finer branches, can be raised from cuttings.

The spruces are important timber trees. The soft and light straight-grained wood is much used for construction, the interior finish of houses and for fuel, also for ship-building; but it is not durable in the ground. The bark of some species is used for tanning leather, and the resinous exudations are sometimes employed in medicine. From the red and black spruce, spruce beer is made by boiling the branches with honey. Spruces are often known in nurseries, especially in this country, under the name of *Abies*.

The grafting of piceas. (E. P. Drew.)

In the writer's experience, *P. canadensis* is a good stock on which to graft the finer varieties of spruce or those having four-sided leaves. Pot the stock the last of August, keep in shaded frame, syringe till danger of wilting is over and harden gradually. Be careful not to keep the earth in the pots too wet, as roots are liable to rot. Place the stocks in greenhouse after light frosts, and graft as soon as roots have started—about last of January generally. Do not wait until buds have made much growth, for then the sap will be running strongly to the upper buds, leaving the cion to remain dormant. When stock and cion are of same size, the veneer-graft may be used. In large stocks, use slit- or side-graft. Be sure that the knife is sharp enough to shave dry wood. Cut the cion in elongated wedge-shape; place it in the cleft by twisting the stock with left hand, fitting the cion exactly with the right. Be careful to wax well, as a



2940. Cone of Norway spruce.—*Picea excelsa*. (×½)

hole the size of a pin left on the cut surface will be fatal to the cion. Place the grafted plants in a close frame until the cion is well started. Syringe from two to three times a day, shading when too hot. Give air gradually until well hardened. Do not cut back the stock for one year, as the cion may make second growth and winter-kill. If cion should die, do not use the stock again until after a year's rest, as two consecutive pottings will usually ruin the plant; this holds good only with *Tsuga* and *P. canadensis*. The above method can be used with equal success on *Pinus*, *Abies*, *Juniperus*, and other evergreens propagated by grafting.

Ornamental value of spruces. (Thomas H. Douglas.)

The piceas embrace some of the most useful as well as ornamental trees of the conifer family. They cover a great variety of forms, from the stiff-branched sturdy and rugged *P. pungens* to the lithe graceful and drooping *P. Breweriana*. The American species comprise

P. mariana, *P. canadensis*, *P. rubra*, *P. pungens*, *P. Engelmannii*, *P. Breueriana*, and *P. sitchensis*. The grand and towering Douglas spruce and the graceful hemlock spruce, so called, are not true spruces and will not be noticed in this article.

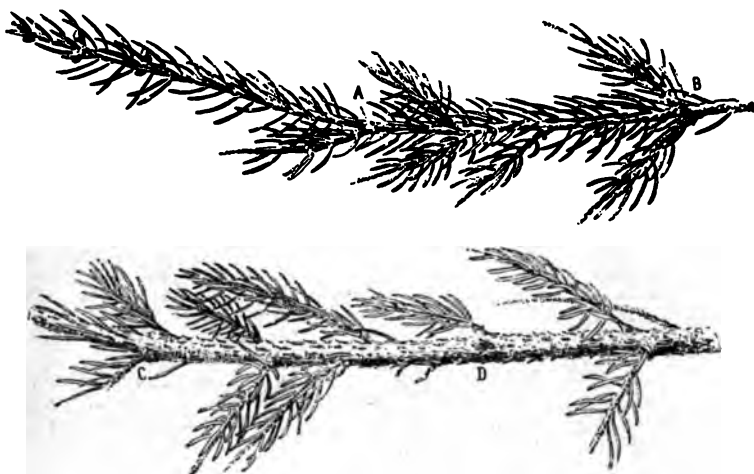
The white spruce, *Picea canadensis*, is a native of the northern parts of America and is justly thought to be one of our best conifers, a compact and upright grower of great longevity; trees growing at Waukegan, Illinois, of mature age, are well branched at the bottom, retain their pyramidal form, and annually make an upward growth. It is the most aromatic of the piceas; in fact, this odor is often used to identify it while young from the Norway spruce or Engelmann's spruce. It grows on a great variety of soils, bears crowding well and also will stand severe pruning; hence it is used for windbreaks and hedges. Seedlings vary considerably in color, some of them fairly rivaling the blue form of the *P. pungens*. This tree, being a native of a cold climate, is subject to the ravages of the red-spider in a warm

from a light silvery hue in some specimens to a dark blue, almost purple in others. In some specimens the branches are in distinct and regular whorls, resembling *Araucaria excelsa*. Undoubtedly the oldest and finest specimens of this grand tree are found on the grounds of the late Robert Douglas, at Waukegan, Illinois. These trees are now 35 to 40 feet high and show no signs of weakness anywhere, being one mass of foliage from the ground upward. The green form of *P. pungens* is an excellent tree, but is not so much appreciated by planters and lovers of trees as it should be, as it is always compared to its more striking variety, the blue spruce. There is a fine specimen growing on the above grounds, even larger than the blue form, which does not suffer in comparison with its near neighbors, *Abies concolor*, *A. Fraseri*, *Picea Engelmannii*, *Tsuga canadensis* or hemlock spruce, *Pseudotsuga Douglasii* or Douglas spruce, and *Pinus Strobus*, all large and fine specimens, equal to any in the Middle West.

Picea mariana, or black spruce, is undoubtedly the poorest tree of the genus from a landscape gardener's point of view. It has very short needles and is greatly disfigured by its cones, which hang on for several years. It begins seeding when very young and is an exceedingly slow grower. Some good specimens of it are found, however, in the East, but in very restricted localities. *P. rubra*, long thought to be a variety of the preceding, is a much better tree in every respect, resembling *P. excelsa* in color and form. It seems to be a short-lived tree, especially in the West. This tree is undoubtedly the least known of the American piceas. *P. sitchensis* of the Pacific Coast strongly resembles *P. pungens*; in fact, when the latter was first introduced it was thought to be a variety of *P. sitchensis*. It has much finer branches and needles than *P. pungens*, varies in coloring as much as the latter, and, where hardy, makes a very fine tree. Unfortunately it is not hardy in any of the northern states. Unlike *P. pungens*, it will not stand close planting, as the needles fall off badly where the branches are rubbed together by the wind or strike other objects.

Without doubt the most graceful and elegant picea is *P. Breueriana*, or weeping spruce, a native of the

Siskiyou and Coast Ranges of mountains in northern California and Oregon. It has the true spruce form, tall and symmetrical, with horizontal branches and a beautiful dark green color. In its general features it resembles a well-grown specimen of the Norway spruce, but its distinguishing beauty is in the long pendent pendulous branchlets which hang straight down from the branches to a length of 6 to 8 feet and no larger around than a lead pencil. It has a stately grace in calm weather, but its characteristic impressiveness is seen only when the long flexible branches are undulating in a light breeze or streaming before a gale. The bark is smooth and reddish in color, adding to its beauty where glimpses of it can be seen through the green foliage. It grows only at high elevations in its native habitat and on the northern slope of the mountains where the annual fall of snow is 15 to 25 feet. The cones are from 2½ to 3½ inches long, of a purplish color, and as they grow only on the tips of the branches they add greatly to its beauty. Unfortunately this beautiful tree has not proved satisfactory. Out of over 300,000 seedlings raised in 1893, only one plant is now alive; it is growing on the Douglas grounds and is scarcely 5 feet tall, having cost over \$100 a



2941. Shedding of the leaves of Norway spruce.—*Picea excelsa*.

The picture shows the extremities of a limb that is eight years old. The part between the tip and A is last season's growth; between A and B it is two years old; and beyond B is a part that grew three seasons ago. The section beyond C is six years old; from C to D is seven years of age. The four years' growth of this limb not shown in the drawing was as densely covered with foliage as is the part shown in the upper figure; but there are not many leaves between C and D (seven years old) and none on the eight-year-old wood (except those on the branchlets, and these are younger). This shows that the leaves persisted six or seven years.

climate and should not be planted south of Philadelphia or St. Louis. There is a variety of *P. canadensis* found in the Black Hills that stands extreme drought better than the northern form and is largely planted on the dry prairies of Nebraska and the Dakotas. It does not, however, do so well in northern Illinois or farther east as the northern variety.

Picea Engelmannii, one of the gems of Colorado, resembles *P. canadensis* more than it does its near neighbor, *P. pungens*, being of finer foliage and not so stiff-branched as the latter. It is one of the few conifers that will stand the extreme cold of Petrograd, Russia, but on our western prairies it soon loses its lower branches, as it seems to be unable to withstand the hot and drying winds of that section in late summer and early autumn. In the eastern states, however, it does not have this fault, as the cooler and more humid air seems better to agree with it.

Another Colorado conifer, *P. pungens* (the blue form being called by some the "queen of the piceas"), is a striking and noble tree, seeming to be hardy wherever tested and on all varieties of soil. Strong, sturdy, and upright in growth, its form alone would make it a striking figure in any landscape. Its beautiful color varies



LXXXVIII. *Picea canadensis* (or *P. alba*).—A golden variety.

P. mariana, *P. canadensis*, *P. rubra*, *P. pungens*, *P. Engelmannii*, *P. Breueriana*, and *P. sitchensis*. The grand and towering Douglas spruce and the graceful hemlock spruce, so called, are not true spruces and will not be noticed in this article.

The white spruce, *Picea canadensis*, is a native of the northern parts of America and is justly thought to be one of our best conifers, a compact and upright grower of great longevity; trees growing at Waukegan, Illinois, of mature age, are well branched at the bottom, retain their pyramidal form, and annually make an upward growth. It is the most aromatic of the piceas; in fact, this odor is often used to identify it while young from the Norway spruce or Engelmann's spruce. It grows on a great variety of soils, bears crowding well and also will stand severe pruning; hence it is used for windbreaks and hedges. Seedlings vary considerably in color, some of them fairly rivaling the blue form of the *P. pungens*. This tree, being a native of a cold climate, is subject to the ravages of the red-spider in a warm

from a light silvery hue in some specimens to a dark blue, almost purple in others. In some specimens the branches are in distinct and regular whorls, resembling *Araucaria excelsa*. Undoubtedly the oldest and finest specimens of this grand tree are found on the grounds of the late Robert Douglas, at Waukegan, Illinois. These trees are now 35 to 40 feet high and show no signs of weakness anywhere, being one mass of foliage from the ground upward. The green form of *P. pungens* is an excellent tree, but is not so much appreciated by planters and lovers of trees as it should be, as it is always compared to its more striking variety, the blue spruce. There is a fine specimen growing on the above grounds, even larger than the blue form, which does not suffer in comparison with its near neighbors, *Abies concolor*, *A. Fraseri*, *Picea Engelmannii*, *Tsuga canadensis* or hemlock spruce, *Pseudotsuga Douglasii* or Douglas spruce, and *Pinus Strobus*, all large and fine specimens, equal to any in the Middle West.

Picea mariana, or black spruce, is undoubtedly the poorest tree of the genus from a landscape gardener's point of view. It has very short needles and is greatly disfigured by its cones, which hang on for several years. It begins seeding when very young and is an exceedingly slow grower. Some good specimens of it are found, however, in the East, but in very restricted localities. *P. rubra*, long thought to be a variety of the preceding, is a much better tree in every respect, resembling *P. excelsa* in color and form. It seems to be a short-lived tree, especially in the West. This tree is undoubtedly the least known of the American piceas. *P. sitchensis* of the Pacific Coast strongly resembles *P. pungens*; in fact, when the latter was first introduced it was thought to be a variety of *P. sitchensis*. It has much finer branches and needles than *P. pungens*, varies in coloring as much as the latter, and, where hardy, makes a very fine tree. Unfortunately it is not hardy in any of the northern states. Unlike *P. pungens*, it will not stand close planting, as the needles fall off badly where the branches are rubbed together by the wind or strike other objects.

Without doubt the most graceful and elegant picea is *P. Breueriana*, or weeping spruce, a native of the Siskiyou and Coast Ranges of mountains in northern California and Oregon. It has the true spruce form, tall and symmetrical, with horizontal branches and a beautiful dark green color. In its general features it resembles a well-grown specimen of the Norway spruce, but its distinguishing beauty is in the long pliant pendulous branchlets which hang straight down from the branches to a length of 6 to 8 feet and no larger around than a lead pencil. It has a stately grace in calm weather, but its characteristic impressiveness is seen only when the long flexible branches are undulating in a light breeze or streaming before a gale. The bark is smooth and reddish in color, adding to its beauty where glimpses of it can be seen through the green foliage. It grows only at high elevations in its native habitat and on the northern slope of the mountains where the annual fall of snow is 15 to 25 feet. The cones are from 2½ to 3½ inches long, of a purplish color, and as they grow only on the tips of the branches they add greatly to its beauty. Unfortunately this beautiful tree has not proved satisfactory. Out of over 300,000 seedlings raised in 1893, only one plant is now alive; it is growing on the Douglas grounds and is scarcely 5 feet tall, having cost over \$100 a



2941. Shedding of the leaves of Norway spruce.—*Picea Excelsa*.

The picture shows the extremities of a limb that is eight years old. The part between the tip and A is last season's growth; between A and B it is two years old; and beyond B is a part that grew three seasons ago. The section beyond C is six years old; from C to D is seven years of age. The four years' growth of this limb not shown in the drawing was as densely covered with foliage as is the part shown in the upper figure; but there are not many leaves between C and D (seven years old) and none on the eight-year-old wood (except those on the branchlets, and these are younger). This shows that the leaves persisted six or seven years.

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70

foot, and this is doubtless one of the largest specimens in cultivation.

Of the foreign piceas, *P. excelsa* is most popular; in fact is the best known and most largely planted of any of the genus. It makes a large fine-looking tree, grows in a great variety of soils, is hardy throughout most of North America, is the most rapid grower of any of the piceas, and stands close planting very well. It is used more than any other tree for windbreaks and shelter-belts. It bears pruning well. Hedges of this species and *P. canadensis* that have been planted more than forty years are growing on the Douglas grounds that are now 8 feet high, and 9½ feet across the base. One fine specimen tree on these grounds measures about 63 feet high and 64 feet from tip to tip of its lower branches. Other foreign species, but not so well known nor so thoroughly tested as the preceding, are *P. obovata*, a close compact-growing tree dark green in color. *P. Smithiana* or *P. Morinda* is one of the handsomest of the piceas, but is not hardy in the northern states, plants from seed collected at an elevation of 8,000 feet on the Himalaya Mountains not proving hardy. Fine specimens of this tree are found in California, where it is justly prized. *P. Omorika* from southeastern Europe is one of the best of the hardy foreign piceas; it does well in the eastern states and forms a narrow pyramid with slender branches clothed with dark glossy foliage. There are several species of Picea from China and Japan that will doubtless prove hardy in the eastern states. Of these *P. jezoensis* var. *hondoensis* has proved one of the best in the eastern states; also *P. bicolor*, which forms a handsome pyramidal tree of rapid growth with dark green foliage, has proved perfectly hardy. All piceas will stand the pruning-knife, but this should be used not later than July 1 in the northern states and earlier farther south. They are propagated from seed the same as larix; and their varieties, of which there are a great number, are either grafted or raised from cuttings over bottom heat.

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KEY TO THE SPECIES.

- A. Lvs. quadrangular, all 4 sides with stomata.
- B. Scales of cone obovate or orbicular, rounded, closely appressed before ripening.
- C. Cones 2½-6 in. long.
- D. Length of lvs. ¾-2 in.: young branchlets glabrous, more or less pendulous.

- M. Lvs. spreading, sometimes 2 in. long: winter buds acute. 1. *Smithiana*
- EE. Lvs. pointing forward, not over 1½ in. long: winter buds obtuse. 2. *Schrenkiana*
- DD. Length of lvs. ½-1 in.
- E. Lvs. spreading, rigid, sharply pointed: branchlets glabrous, pale yellow. 3. *polita*
- EE. Lvs. pointing forward.
- F. Young branchlets pale yellowish gray, pubescent: petioles very prominent, often recurved. 4. *asperata*
- FF. Young branchlets brown, puberulous or glabrous.
- G. Cones 4-6 in. long, or shorter in some varieties with stiff scales: branchlets glabrous or sparingly hairy. 5. *excelsa*
- GG. Cones less than 4 in. long, with flexible scales: branchlets puberulous. 6. *obovata*
- DDD. Length of lvs. less than ½ in.: lvs. bright green, lustrous, obtusish: branchlets pubescent, light brown. 7. *orientalis*
- CC. Cones ¼-2 in. long.
- D. Young branchlets pubescent.
- E. Color of lvs. dark green, lustrous: cones ovate-oblong, very short-stalked, deciduous; scales entire or denticulate. 8. *rubra*
- EE. Color of lvs. dull, usually bluish green: cones ovate, distinctly stalked, persistent for many years; scales erose or dentate. 9. *mariana*
- DD. Young branchlets glabrous, light brownish yellow. 10. *canadensis*
- BB. Scales of cone oblong or rhomboidal, erose at the margin and usually striate and undulate, thin, very loosely appressed or slightly spreading.
- C. Winter buds with appressed scales: branchlets pubescent: lvs. pointing forward, rather flexible. 11. *Engelmannii*
- CC. Winter buds with loose scales revolute at the apex: branchlets glabrous: lvs. spreading, rigid. 12. *pungens*
- AA. Lvs. more or less compressed, with 2 white lines above, green below or sometimes with few stomata.
- B. Cone-scales rhomboidal, erose-denticulate, flexible, loosely appressed.
- C. Cones brown at maturity: lvs. flattened.
- D. Bracts visible between the scales of the cone: lvs. rigid, pungent; mature branchlets orange-brown: winter buds ovate. 13. *sitchensis*
- DD. Bracts not visible: lvs. not pungent: mature branchlets greenish to light reddish brown: winter buds conical. 14. *jezoensis*
- CC. Cones purple: branchlets orange-yellow, setose: lvs. quadrangular, somewhat compressed. 15. *purpurea*
- BB. Cone-scales orbicular or obovate, closely appressed before maturity.
- C. Branchlets glabrous, only leading shoot more or less hairy or all pubescent: lvs. quadrangular, somewhat compressed. 16. *bicolor*
- CC. Branchlets always pubescent: lvs. much compressed.
- D. Lvs. keeled, ¼-½ in. long: branchlets short. 17. *Omorika*
- DD. Lvs. nearly rounded on both sides, ½-1 in. long: branchlets long, drooping. 18. *Breweriana*

Section I. EUPICEA, Willk.

Lvs. quadrangular, with stomata on all 4 sides: scales of cone closely appressed before maturity, broad and entire or nearly so.

1. *Smithiana*, Boiss. (*P. Morinda*, Link. *P. Khutrow*, Carr.). Tree, to 150 ft., with wide-spreading branches and slender pendulous branchlets: lvs. crowded, usually thicker than broad, acute, bright or dark green, $\frac{3}{4}$ –2 in. long: pistillate fls. purple: cones 5–7 in. long, dark brown and glossy; scales suborbicular, with entire margin, firm. Himalayas. G.C. II. 24:393; III. 35:325; 38:395. Gn. 19, p. 359; 35, p. 599; 39, p. 72. C.L.A. 7:364. F.E. 16:705.—One of the most graceful spruces; hardy as far north as N. Y. The young growth starts very early and is liable to be injured by frost in spring, especially when planted in warm and damp situations.

2. *Schrenkiana*, Fisch. & Mey. (*P. obovata* var. *Schrenkiana*, Carr.). Tall pyramidal tree, with pendulous branchlets, somewhat similar to *P. excelsa*: lvs. equally 4-sided, acute, somewhat dull green, $\frac{3}{4}$ –1½ in. long, on young plants often slightly shorter: cones cylindric-ovate, 3–4 in. long; scales with entire margin. Siberia to N. China.—Similar in habit to the preceding species but branchlets not so long and lvs. shorter. A very desirable and hardy spruce. Var. *globosa*, Schelle. About 6 ft. high, globose in shape.

3. *polita*, Carr. (*P. Tordno*, Koehne. *P. bicolor*, Hort., not Maxim.). Tree, to 90 ft., forming a dense, broad pyramid, with rigid stout branches when young, older trees with the habit of *P. excelsa*, with somewhat pendulous branches: young branches thick, glabrous, yellowish brown: lvs. rigid, thicker than broad, often falcate, shining dark green, $\frac{1}{2}$ –1 in. long: pistillate fls. green, staminate yellowish: cone oblong, 4–5 in. long, brown, glossy; scales with finely denticulate margin. Japan. S.Z. 2:111. G.C. II. 13:233; III. 21:251. Gn. 13, p. 239. S.I.F. 2:2.—One of the most distinct spruces; of very striking appearance with its rigid spiny lvs. spreading in all directions from the stout branches, but usually of rather irregular habit.

4. *asperata*, Mast. Tree, to 100 ft., with grayish brown bark peeling off in thin flakes: branchlets pale yellowish gray, pubescent: lf.-cushions with often spreading or recurved petioles: lvs. quadrangular, curved, $\frac{1}{2}$ in. long or slightly longer, acute or acutish and beveled at the apex: cones cylindric-oblong, $\frac{3}{4}$ –4 in. long, fawn-gray when ripe, finally changing to



2942. *Picea mariana* (×½). No. 9.

chestnut-brown; cone-scales usually rounded and entire at the apex. W. China.—A valuable timber tree. Var. *notabilis*, Rehd. & Wilson. Lvs. $\frac{1}{2}$ –¾ in. long: cones $\frac{3}{4}$ –5 in. long; scales rhombic-ovate, narrowed toward the apex. Var. *ponderosa*, Rehd. & Wilson. Bark thicker, brownish gray: branchlets nearly glabrous, yellowish: cones 5–6 in. long.

5. *excelsa*, Link (*P. Abies*, Karst. *P. rubra*, A. Dietr. *Pinus Abies*, Linn. *Pinus Picea*, Dur.). Norway Spruce. Figs. 2940, 2941. Tree, to 150 ft., with spreading branches and usually pendulous branchlets: bark reddish brown: young branches brown, glabrous or pubescent: lvs. quadrangular, acute, dark green and usually shining, $\frac{1}{2}$ –1 in. long: staminate and pistillate

fls. bright purple: cones cylindric-oblong, 4–7 in. long, light brown; scales obovate, with erose-denticulate margin. N. and Cent. Eu. Em. 1:102. Mn. 4, p. 185; 6, p. 85. F.E. 15:350, pl. 50. H.W. 1:1, pp. 54–61. C.L.A. 11:311. G.W. 2, p. 535; 6, p. 322.—Though *P. Abies* is the correct name for this species according to the rules of priority, we have retained here the name *P. excelsa*, because *Picea Abies* and *Abies Picea* might be easily confused and are certainly somewhat perplexing. It seems therefore advisable to take the next oldest names which are *Picea excelsa* for the Norway spruce and *Abies alba*, Mill., for the silver fir.—This tree is extensively planted as an ornamental tree in the northern and eastern states; it is of rapid growth and is a handsome tree, with its graceful habit and dark green dense foliage, but, like many spruces and firs, loses much of its beauty when it grows old, and usually after 30 years it becomes thin and ragged in the top. It is one of the best conifers to plant for shelters and windbreaks. The Norway spruce is very variable, and a great number of garden forms are in cult. Some of the more important are the following:

Pendulous or sparingly branched forms of P. excelsa: Var. *virgata*, Casp. (var. *denuddata*, Carr.). Sparingly branched, with long and slender branches destitute of branchlets, spreading, usually the lower ones pendulous and the upper ones ascending. R. H. 1854, p. 102. G.W. 3, p. 523; 6, p. 607. M.D.G. 1894:31. H.W. 1, p. 63. *P. excelsa* var. *elata*, Hort., is probably a seedling of this variety and an intermediate form varying toward the type. Var. *monströsa*, Beissn. (var. *monocaulis*, Nördl. *Abies excelsa monströsa*, Loud.), is an extreme form of the preceding and is destitute of all branches; it consists only of a single st. clothed with thick rigid lvs. Var. *viminialis*, Casp. Branches in remote whorls, almost horizontal, with very long and slender branchlets without or with very few lateral branchlets. G.W. 3, p. 433; 9, p. 411. M.D.G. 1902:257; 1906:557. Gt. 38, p. 136. H.W. 1, p. 64. Var. *pendula*, Jacq. & Herincq (var. *reflexa*, Carr.). With pendulous branches and branchlets; whorls of branches often irregular. Gt. 48, pp. 618, 619; 50, p. 315; 52, p. 434. G.W. 3, p. 213. R.H. 1890, p. 259. Var. *inversa*, Beissn. (*Abies excelsa inverta*, Gord.). Similar to the preceding, but branches more closely appressed to the st., more densely branched, with thick lustrous lvs. Gng. 6:100. F.E. 22:765. G.M. 54:976. Gn.M. 2:24. G.C. III. 22:369; 29:263. Gt. 50, p. 317. B.H. 10, p. 300.

Columnar forms: Var. *pyramidalis*, Carr. (var. *erecta*, Schröter). With branches ascending at an acute angle, forming a narrow, nearly columnar pyramid. Var. *columnaris*, Carr. With very short, horizontal much ramified branches, forming a narrow column. M.D. 1911, p. 260. Var. *cupressina*, Thomas, is similar. M.D. 1907, p. 252.

Dwarf and dense, pyramidal, subglobose or prostrate forms: Var. *conica*, Carr. A dense conical pyramid with ascending branches and slender branchlets: lvs. thin and pointed. Var. *Remontii*, Beissn. A dense ovate or pyramidal form with short and dense branches. G.M. 54:222. F.E. 16:491. M.D.G. 1906:557. Var. *Clanbrasiliana*, Carr. (*Abies excelsa Clanbrasiliana*, Loud.). A compact roundish or broadly conical form with short and crowded branches: lvs. short and thick. M.D. 1906:222. G.M. 57:634. Var. *compacta*, Beissn. A subglobose dense form with slender branchlets and acute short lvs. F.E. 16:585, pl. 65. Var. *Gregoryana*, Beissn. (*Abies excelsa* var. *Gregoryana*, Gord.). A compact subglobose form densely branched, with short thickish pungent lvs. Var. *pygmaea*, Carr. A very dense, small, pyramidal form with ascending branches and bright green lvs. Gn.M. 2:23. Var. *nana*, Carr. A depressed subglobose form with dense horizontally spreading branches and short sometimes monstrous branchlets. Var. *tabuliformis*, Carr. A low flat form

with horizontally spreading branches. Var. *procumbens*, Carr. A prostrate form with numerous short branchlets and dense short and pointed lvs. Var. *dumosa*, Carr. Similar to the preceding, but less densely branched and lvs. more distant. Var. *repens*, Simon-Louis. A creeping form.

Low, irregularly branched monstrous forms: Var. *Barryi*, Beissn. With vigorous thick branches and few short branchlets, dark green. Var. *Ellwangeriana*, Beissn. A broad growing form with crowded slender branchlets and small and thin, acute lvs. Var. *capitata*, Carr. Dwarf bushy form, with numerous short branchlets in dense heads at the end of the branches. R.H. 1889, p. 393. Var. *Maxwellii*, Beissn. A low flat dense form, the young branches brown, often with short fasciated branchlets: lvs. bright green, rigid, pointed.

Variagated forms: Var. *finedonensis*, Beissn. (*Abies excelsa finedonensis*, Gord.). Lvs. pale yellow at first, becoming bronzy brown and finally green. Var. *argenteo-spicata*, Hesse. Young shoots whitish. Var. *atra*, Carr. Lvs. golden yellow on the exposed side; does best in a partly shaded situation. Var. *mutabilis*, Carr. Young shoots yellow, changing soon to green. G.W. 3, p. 556.

The most important of the geographical forms are: Var. *fennica*, Rupr. Similar to *P. obovata*: cones not more than 3 in. long. N. Eu. and N. Asia. Var. *mediocrima*, Nyland. Small tree or sometimes shrubby: lvs. thickish, shorter, lustrous, green: cones to 3 in. long. Resembles somewhat *P. orientalis*. N. Eu. Var. *alpestris*, Brügg. Slow-growing compact tree: young branchlets velutinous: lvs. shorter, usually obtusish, dull yellowish or grayish green: cones 3-5 in. long. Resembles in habit and foliage somewhat *P. canadensis*. In the Alps at high altitudes.—There are two forms of the common Norway spruce differing in the color of the young cones: Var. *chlorocarpa*, Purk. Young cones green: lvs. obtusish, more appressed; leafing later. Var. *erythrocarpa*, Purk. Young cones violet-purple: lvs. more spreading, pointed; leafing earlier.

6. *obovata*, Ledeb. (*P. excelsa* var. *obovata*, Koch). Tree, to 100 ft., similar in habit to the following, with somewhat pendulous branchlets: young branches brown, glabrous or slightly pubescent: lvs. quadrangular, acute, dull or bluish green, $\frac{1}{4}$ - $\frac{3}{4}$ in. long: pistillate fls. purple: cone oblong-ovate, light brown, about 2½ in. long; scales with entire margin. N. Eu. to Kamchatka and Manchuria. Gn. 20, p. 91. R.H. 1894, p. 274. Mn. 5, p. 189.—Of slower growth than *P. excelsa* and more graceful.

7. *orientalis*, Carr. Tree, to 120 ft., with ascending and spreading branches and somewhat pendulous branchlets: young branches brown, pubescent: lvs. thick, obtuse, dark green and shining, crowded and more or less appressed to the branches: fls. carmine: cone cylindric-ovate, 2½-3½ in. long, less than 1 in. thick; scales orbicular, entire at the margin. W. Asia, Caucasus. G.C. II. 21:308; 25:333; III. 3:754. A.G. 19:649. Mn. 5, p. 189. V. 20:185. C.L.A. 11:311. Gn.M. 2:25. G.W. 16, p. 261.—A very graceful spruce with dark, glossy foliage; of slow growth and therefore valuable for smaller gardens. It holds its lower limbs for many years. Var. *nana*, Carr. Low form of broadly pyramidal habit, with wide-spreading branches. Var. *aureo-spicata*, Beissn. Young shoots yellow. Var. *nuttana*, Niemetz. With graceful hanging branches. Var. *semi-virgata*, Schwerin. Branches with few lateral branchlets, which gives the plant a loose slender appearance.

8. *rubra*, Link, not A. Dietr. (*P. australis*, Small. *P. rubens*, Sarg.). RED SPRUCE. Tree, to 80 ft., or occasionally to 100 ft., with short and slender branches forming a narrow pyramidal head, with red-brown bark: young branches reddish brown: lvs. quadrangular, acute or mucronate, dark or bright green, shining, about ½ in. long: fls. purple: cones oblong, 1¼-2 in. long, green while young, later light reddish brown, glossy;

scales obovate, rounded and entire or slightly erose at the margin. From Canada to N. C., along the Alleghany Mts. S.S. 12:597.—Handsome tree, but requires cool and moist situation and is less drought-enduring than most others. Var. *virgata*, Rehd., is a sparingly branched form with long and slender branches destitute of branchlets, very similar to *P. excelsa* var. *virgata*. G.F. 8:45.

9. *mariana*, BSP. (*P. nigra*, Link. *P. brevifolia*, Peck). The native BLACK SPRUCE. Figs. 2942, 2943. Tree, usually to 20-30 ft. or occasionally to 100 ft., with slender, often pendulous branches forming a narrow,



2943. Cones of piceas. Largest one, *P. pungens*; lowest one, *P. canadensis*; upper right hand, *P. mariana*. (×¼)

irregular head: bark gray-brown: young branches brown or yellowish brown: lvs. quadrangular, obtusish, dull dark or bluish green, bloomy especially on the upper side, $\frac{1}{4}$ - $\frac{3}{4}$ in. long: fls. purple: cones oval-oblong, globose-ovate when open, dark purple while young, later dull grayish brown, $\frac{1}{2}$ -1½ in. long; scales rounded and finely denticulate at the margin. From Canada to Va., Minn. and Brit. Col. S.S. 12:596.—Very variable in habit; cone-bearing trees often only a few feet high when growing in swamps. The most ornamental garden form is var. *Doumetii*, Schneid. (*P. nigra Doumetii*, Carr.), with ascending crowded branches forming a dense conical pyramid. A similar form, somewhat broader at the base with more light bluish green foliage, is var. *Beissneriana*, Rehd. (*P. nigra mariana*, Beissn.). G.C. III. 11:80. Var. *fastigiata*, Rehd. (*P. nigra fastigiata*, Carr. *Abies nigra pumila*, Knight). A columnar form with ascending branches and short, acute lvs. Var. *nana*, Rehd. (*P. nigra nana*, Beissn.). A dwarf subglobose form with light bluish green lvs. Gt. 50, p. 193.

10. *canadensis*, BSP. (*P. alba*, Link. *P. larx*, Sarg.). The native WHITE SPRUCE. Figs. 2943, 2944. Tree, usually 60-70 ft., with ascendent branches and usually pendent branchlets: bark light brownish gray: lvs. slightly curved, acute or acutish, more or less bluish green, $\frac{1}{2}$ -¾ in. long, of a strong, aromatic odor when bruised: fls. pale red or yellowish: cones cylindric-oblong, light brown and glossy, 1½-2 in. long; scales orbicular, with usually entire margin, thin and flexible. From Labrador to Alaska, south to Mont., Minn., and N. Y. S.S. 12:598. G.F. 8:223 (adapted in Fig. 2944); 9:355. F.S. 21:2251. C.L.A. 11:311. F.E. 29:81. Gn. M. 4:19. M.D.G. 1899:80.—A decorative species of dense habit when young and with rather light bluish green foliage; it endures heat and drought much better than the two preceding species. The most important garden form is var. *cærulea*, Schneid. (*P. alba caerulea*, Carr. *P. alba argentea* and var. *glauca*, Hort. *Abies rubra violacea*, Loud.). Of dense habit with light bluish green or almost silvery white lvs. Var. *pendula*, Schneid. (*P. alba pendula*, Beissn.). With pendulous branches. An important geographical variety is var. *albertiana*, Rehd. (*P. albertiana*, S. Br. *P. alba albertiana*, Beissn.). Tree, to 100 or occasionally 150 ft., of narrow pyramidal habit: branchlets sometimes minutely pubescent: lvs. more crowded: lf.-cushions longer: cones shorter with more rigid rounded scales. Alberta. M.D.G. 1905:117 (as *P. alba*).

Section II. CASICTA, Mayr.

Lvs. quadrangular or more or less compressed: scales of cone loosely appressed before maturity, rhombic and usually elongated, erose-denticulate, and more or less wavy on the margin.

11. *Engelmannii*, Engelm. (*P. columbiana*, Lemmon). *Abies commulata*, Murr.). ENGELMANN SPRUCE. Tree, to 150 ft., with slender spreading branches in closely arranged whorls, forming a dense and narrow pyramid in young trees: winter buds with brownish yellow usually appressed or little spreading scales: young branches pale brownish yellow, pubescent: lvs. slender, straight or slightly incurved, acute, bluish green to steel-blue, $\frac{1}{2}$ –1 in. long, without resin canals, of a strong aromatic odor when bruised: fls. purple: cones oval to cylindric-oblong, light brown, $1\frac{1}{4}$ –3 in. long; scales rhomboidal, narrowed and truncate or rarely acute at the apex. From Alberta and Brit. Col. to Ariz. and New Mex. S.S. 12:599. Gn.M. 2:26. F.E. 27:39. M.D.G. 1905:121, 122.—A very ornamental tree, varying in the color of foliage. Var. *glauca*, Beissn., has bluish or steel-blue, and var. *argentea*, Beissn., silvery gray foliage. M.D.G. 1906:557. *P. pseudopungens*, Dieck, seems not to differ from typical *P. Engelmannii*. The latter is said to be sold for *P. pungens*. It is more common, and its seeds are therefore more readily secured.

12. *pungens*, Engelm. (*P. Parryana*, Sarg. *Abies Menziesii*, Engelm., not Lindl.). COLORADO SPRUCE. Fig. 2943. Tree, 80–100, or occasionally to 150 ft., with horizontal stout branches in rather remote whorls, forming a broad, regular pyramid: winter buds with brownish yellow usually reflexed scales: young branches glabrous, bright yellowish brown: lvs. rigid, incurved, spiny-acuminate, bluish green to silvery white or rarely dull green, $\frac{3}{4}$ –1½ in. long, with 2 resin canals: cones cylindric-oblong, light brown and glossy, $2\frac{1}{2}$ –4 in. long; scales rhomboidal, narrowed and erose at the apex. Wyo. to Colo. and Utah. S.S. 12:600. G.C. II. 20:725; III. 10:547. Mn. 7, p. 51. Gng. 7:49. S.H. 2:273. F. 1884, p. 5. G.M. 40:35.—A very handsome and very hardy tree of symmetrical habit, with light, sometimes almost silvery white foliage. According to the different shades of color of the foliage, the following varieties are distinguished: Var. *glauca*, Beissn. With bluish green lvs. Gn. 63, p. 280. G.M. 50:121. Gn. M. 2:26. G.W. 1, p. 355; 14, p. 14. R.B. 32, p. 106. Var. *caerulea*, Beissn. With bluish white foliage. G.W. 1, p. 357. Var. *argentea*, Beissn. With silvery white foliage. Gt. 53, p. 493. G.W. 2, p. 295; 8, p. 481; 10, p. 48. M.D.G. 1901:178. Var. *Kosteri*, Beissn. With silvery white foliage and of very regular pyramidal habit. G.W. 15, p. 467. F.E. 16:461; 18:82. Var. *glauca pendula*, Beissn. With bluish foliage and pendulous branches. R.H. 1901, p. 183. F.E. 32:1173. G.W. 6, p. 399; 9, p. 543; 16, p. 79. M.D.G. 1901:133. Var. *viridis*, Regel (*P. commulata*, Hort.), is the form with green lvs. Var. *compacta*, Rehd. A dwarf compact form; originated at the Arnold Arboretum. Var. *aurea*, Niemetz. With golden yellow foliage. Var. *flavescens*, Niemetz. With whitish yellow foliage. Var. *Morheimii*, Rujis. Grows more compact and foliage deeper blue.

13. *sitchensis*, Carr. (*Abies Menziesii*, Lindl.). TIDELAND SPRUCE. SITKA SPRUCE. Tree, usually 100 ft., occasionally 200 ft. high, with slender horizontal branches, forming a broad pyramid in young trees; in old trees the upper branches short and ascending, the lower ones slender and spreading, clothed with slender

branchlets: bark bright or dark red-brown: young branches rigid, light brownish yellow, glabrous: lvs. bright green, shining and rounded on the lower side, flat, slightly ridged and silvery white on the upper side, sharply acute or acuminate, $\frac{1}{2}$ –1 in. long: staminate fls. red: cones cylindric-oval, pale yellowish or reddish brown, $2\frac{1}{2}$ –4 in. long; scales rounded at the apex and erose. Alaska to Calif. G.C. II. 25:728, 729. S.S. 12:602. G.F. 4:211 (erroneously named Douglas fir). M.D.G. 1896:403; 1905:123.—A very ornamental tree, especially attractive by the contrasting colors of the foliage, but it can hardly be grown successfully in the eastern states; it does not stand the hot summers well, and is probably not hardy farther north than Mass. Var. *speciosa*, Beissn., is of slower growth and more compact habit, with more ascending branches and shorter, more rigid lvs.

14. *jezoensis*, Maxim. (*P. ajanensis*, Fisch. *Abies jezoensis*, Sieb. & Zucc. *Abies Alcockiana*, Veitch, partly). Tree, 100–150 ft., or occasionally higher, with horizontally spreading slender branches: bark dark gray: young branches glabrous, shining, yellowish brown or yellowish green: lf.-cushions slightly swollen, with usually recurved petioles: lvs. slightly curved, acute, slender, slightly ridged on both sides, dark green and shining below, silvery white above, $\frac{1}{2}$ –¾ in. long: fls. carmine: cones oblong, light brown, $1\frac{1}{2}$ –3½ in. long; scales oval-oblong, erose. E. Siberia, Amurland, Saghalin, N. Japan. G.C. II. 13:115, 212; III. 3, p. 53. J.H.S. 26, p. 104. S.I.F. 2:3. Gt. 38, p. 217, figs. 2–5. Var. *hondoensis*, Rehd. (*P. hondoensis*, Mayr. *P. ajanensis* var. *microsperma*, Beissn., not Mast.). Tree, to 100 ft.: branchlets light reddish brown with much swollen lf.-cushions: lvs. shorter, more obtuse, dull green below. Cent. Japan. B.M. 6743. J.H.S. 26, p. 103. R.H. 1903, p. 341, and G.W. 1:358 (as *P. ajanensis*). S.I.F. 1:5.—The type is rarely cult; it does not grow well in the eastern states and suffers sometimes from late frosts, owing to its early leafing. The variety is much more satisfactory; it is not likely to suffer from frost, as it leafs later, and is a highly ornamental perfectly hardy tree.

15. *purpurea*, Mast. Tree, to 60 ft. with wide-spreading branches: branchlets orange-yellow, hispid: winter buds broadly ovoid: lvs. quadrangular, more or less compressed, curved, obtuse or acutish, with 2 white bands above, green beneath, sometimes with a few stomata, $\frac{1}{3}$ –½ in. long: cones cylindric-oblong, 2–2½ in. long, purple, even more or less so at maturity; scales rhombic-oblong, contracted, narrowed from about the middle, erose-denticulate, acutish or truncate at the apex. W. China.—Very handsome with its numerous purple cones.

Section III. OMORIKA, Mayr.

Lvs. more or less compressed, with glaucous lines above, green below: scales of cone closely appressed before maturity, broad and entire or nearly so on the margin.

16. *bicolor*, Mayr (*P. Alcockiana*, Carr., partly. *P. Alcockiana nova*, Hort. *Abies bicolor*, Maxim.). Tree, 80–150 ft., with rather stiff, spreading branches: bark grayish brown: young branches dull yellowish brown, glabrous, usually only leading shoots pubescent: lvs. somewhat curved, with 2 bluish lines above, dark green beneath, sharply acuminate, $\frac{1}{2}$ –¾ in. long: cones oblong, brown, purple before ripening, 3–4 in. long; scales obovate, finely denticulate and slightly wavy at the often recurved margin. Japan. G.C. II. 13, p. 213. C.L.A. 11:311. Gn.M. 2:24. R.H. 1903, p. 340. S.I.F. 1:4.—Handsome tree, with less slender branches than *P. jezoensis* and of more rapid growth. Var. *acicularis*, Shirasawa (*P. acicularis*, Maxim. *P. japonica*, Regel). Branchlets finely pubescent: lvs. curved, acute, bluish white above: cones light reddish



2944. *Picea canadensis*. Abnormal spikes pistillate at apex.

brown, with entire not wavy scales. Cent. Japan. M.D. 1914:257. Var. *reflexa*, Shirasawa. Branchlets pubescent, light brown: lvs. more or less curved, acute, bluish white above, about $\frac{1}{2}$ in. long: cones light reddish brown; scales nearly entire, not wavy, at the apex slightly attenuate and recurved. Cent. Japan. M.D. 1914:257.

17. *Omōrika*, Bolle (*Pinus Omōrika*, Panic). Tree, to 100 ft. or higher, with rather short spreading and ascending branches forming a narrow pyramidal head: young branches brown, pubescent: lvs. compressed, ridged on both sides, obtuse and mucronulate, dark green and shining below, with whitish lines above, $\frac{1}{2}$ – $\frac{3}{4}$ in. long: fls. purple: cones ovate-oblong, cinnamon-brown, glossy, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long; scales almost orbicular, with finely denticulate margin. S. E. Eu. G.C. II. 21:308; III. 21:153. Gt. 47, p. 177. R.H. 1905, p. 239.—Handsome tree of rather slow growth, forming a dense and narrow pyramid when young; very hardy.

18. *Breweriāna*, Wats. Tree, 80–120 ft. high, with the branches at the top slightly ascending, the lower ones horizontal or pendulous, with whip-like pendulous branchlets often 7 or 8 ft. long, furnished with similar, slender lateral branchlets; young branches reddish brown, pubescent: lvs. straight or slightly curved, obtuse, rounded and dark green at the lower surface, almost flat and with white lines above, $\frac{3}{4}$ –1 in. long: staminate fls. purple: cones oblong, $2\frac{1}{2}$ –5 in. long, light orange-brown; scales obovate, with entire margin. Siskiyou Mts. in Ore. and N. Calif. S.S. 12:601. G.F. 3:66, 67; 5:595. G.C. II. 25:497. M.D.G. 1905:123.—One of the most distinct spruces, but does not seem to do well in the eastern states.

The Roman figure indicates the section to which the species belongs: *P. ascendens*, Patschke. (Section III.) Tree, to 80 ft.: branchlets pale brown, glabrous: lvs. about $\frac{1}{2}$ in. long, compressed, with 2 white lines above: cones 3–4 in. long, with obovate truncate scales. W. China.—*P. aurantiaca*, Mast. (I.) Allied to *P. asperata*. Tree, to 40 ft., with pale gray bark: branchlets orange, glabrous: lvs. quadrangular, about $\frac{1}{2}$ in. long: cones 4–5 in. long, brown, with broad, rounded, slightly erose scales. W. China.—*P. Balfouriana*, Rehd. & Wilson. (II.) Allied to *P. purpurea*. Tree, to 120 ft.: branchlets villous, yellowish: lvs. $\frac{1}{2}$ – $\frac{1}{2}$ in. long, compressed, whitish above, acute or obtusish: cones purplish, $2\frac{3}{4}$ in. long, with rhombic denticulate scales. W. China.—*P. brachytyla*, Pritz. (*P. pachyclada*, Patschke). (III.) Tree, to 70 ft.: branchlets brown, nearly glabrous: lvs. $\frac{1}{2}$ in. long, compressed, white above: cones 3–4 in. long, with obovate scales entire at the margin. W. China.—*P. complanata*, Mast. (III.) Tree, to 80 ft., with gray bark: branchlets orange-brown, pubescent or sometimes glabrous: lvs. flattened, acute, white above, $\frac{1}{2}$ in. long: cones reddish brown, 5–6 in. long, with broad rounded or truncate scales. W. China. G.C. III. 39:147.—*P. Glehnii*, Mast. (III.) Tree, to 150 ft.: branchlets brown, pubescent: lvs. $\frac{1}{2}$ in. long, obtusely quadrangular, whitish above, green beneath: cones brown, violet-purple while young, $1\frac{1}{2}$ –2 in. long, with broad rounded erose scales. Amurl., Saghalin, N. Japan. G.C. II. 13:301. S.I.F. 2:3.—*P. heterolepis*, Rehd. & Wilson. (I.) Allied to *P. asperata*. Tree, to 80 ft.: branchlets brownish, glabrous: lvs. quadrangular, thick, pungent, $\frac{1}{2}$ – $\frac{3}{4}$ in. long: cones $3\frac{1}{2}$ – $5\frac{1}{4}$ in. long, pale brown, with rigid rhombic-obovate scales, emarginate or bifid at the apex. W. China.—*P. Koyamai*, Shirasawa. (III.) Allied to *P. Glehnii*. Tree, to 80 ft.: branchlets bright reddish brown, glabrous: lvs. quadrangular, $\frac{1}{2}$ – $\frac{1}{2}$ in. long, acutish, bluish white above: cones light brownish green, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long; scales broadly obovate, rounded, entire. Cent. Japan. M.D. 1914:257.—*P. likiangensis*, Pritz. (II.) Tree, to 80 ft.: branchlets light yellow-gray, sparingly hairy: lvs. quadrangular, slightly compressed, $\frac{1}{2}$ in. long, white above: cone about 2 in. long with rhombic-ovate, erose, flexible scales. W. China.—*P. Mastersii*, Mayr.—*P. Wilsonii*.—*P. Maximowiczii*, Regel (*P. Tachonoskii*, Mayr. *P. excelsa* var. *obovata japonica*, Beissn.). (I.) Allied to *P. obovata*. Small bushy tree: branchlets reddish brown, glabrous: lvs. rigid, pointed, spreading, about $\frac{1}{2}$ in. long: cones $1\frac{1}{2}$ –2 in. long, lustrous brown, with broad rounded scales. Japan.—*P. Meyerii*, Rehd. & Wilson. (I.) Allied to *P. asperata*. Medium-sized tree: branchlets cinnamon-brown, hairy: lvs. quadrangular, slightly compressed, curved, obtusish, $\frac{1}{2}$ – $\frac{3}{4}$ in. long: cones $2\frac{1}{2}$ – $\frac{3}{4}$ in. long, lustrous brown, with rounded or truncate scales. N. China.—*P. montigena*, Mast. (II.) Tree, to 100 ft.: branchlets pale brown, hairy: lvs. quadrangular, $\frac{1}{2}$ in. long, curved, acutish: cones brown, 3–4 in. long, with rhombic-ovate, flexible, erose scales. W. China. G.C. III. 39:146 (except the cone).—*P. morindoides*, Rehd. = *P. spinulosa*.—*P. Moberi*, Mast. (*P. jessoensis* x *P. mariana* Doumerii). Branchlets smooth, olive: lvs. quadrangular, acute, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, glaucous above, green below. Garden origin. J.H.S. 28:105.—*P. pachyclada*, Patschke.—*P. brachytyla*.—*P. retrofracta*, Mast. (I.) Tree, to 120 ft.: branchlets glabrous, rarely slightly hairy, bright yellow, rarely brownish orange: lvs. quad-

angular, pungent, $\frac{1}{2}$ –1 in. long: cone lustrous brown, $3\frac{1}{4}$ in. long, with obovate, rounded, stiff scales. W. China.—*P. Sargentiana*, Rehd. & Wilson. (III.) Tree, to 70 ft.: branchlets yellow or orange, glandular: lvs. compressed, acutish or obtuse, about $\frac{1}{2}$ in. long, white above, lustrous green beneath: cones $2\frac{1}{2}$ –5 in. long, brown, with obovate, rounded or truncate scales. W. China.—*P. spinulosa*, Griff. (*P. morindoides*, Rehd.). (III.) Tree, with spreading branches and slender pendulous branchlets: lvs. 1– $1\frac{1}{2}$ in. long, pungent, slightly compressed, glaucous above: cone 3–4 in. long, yellowish brown, with rhombic obovate scales minutely denticulate. E. Himalayas. B.M. 8189. G.C. III. 39:218, 274. R.H. 1908, p. 517. G.M. 51:47. S.T.S. 1:48. Tender.—*P. Tachonoskii*, Mayr.—*P. Maximowiczii*.—*P. Watsoniana*, Mast. (I.) Tree, to 40 ft.: branchlets glabrous: lvs. quadrangular, slender, $\frac{1}{2}$ in. long, bright green: cones $2\frac{1}{2}$ – $\frac{3}{4}$ in. long with obovate, rounded scales. W. China.—*P. Wilsonii*, Mast. (*P. Mastersii*, Mayr.). (I.) Tree, to 80 ft.: branchlets glabrous, pale gray: winter buds ovoid, dark brown, lustrous: lvs. quadrangular, curved, acute, $\frac{1}{2}$ in. long: cones cylindric-oblong, $1\frac{1}{2}$ –2 in., brown; scales suborbicular, entire, finally recurved at margin. Cent. China. G.C. III. 33:133. Not in cult. are the following species: *P. gemmata*, Rehd. & Wilson, *P. hirtella*, Rehd. & Wilson, *P. Neoreichii*, Mast. (G.C. III. 33:116), from China, and *P. Morrisonicola*, Hayata, from Formosa.

ALFRED REHDER.

PICKEREL-WEED: *Pontederia*.

PICOTEE: *Carnation*.

PICRÁSMA (Greek, *pikrasmos*, bitterness; referring to the bitter bark and wood). Including *Picræna*. *Simarubaceæ*. Trees and shrubs, with alternate odd-pinnate lvs., yellowish green fls. in axillary long-peduncled loose cymes, and subglobose dry berry-like fr. About 8 species in S. and E. Asia and W. India. *P. quassioides*, Bennett (*P. ailanthisoides*, Planch. *P. japonica*, Gray), seems to be the only species in cult. It is an upright shrub or small tree to 30 ft., almost glabrous except the tomentulose infl.: lvs. with 4–8 pairs of lfts.; lfts. ovate or oblong-ovate, acuminate, crenately serrate, $2\frac{1}{2}$ – $3\frac{1}{2}$ in. long: fr. pea-sized, bright red, with 1 seed. Himalayas, China, Japan. S.I.F. 1:53. This is probably the hardest species of the genus, and has proved hardy at the Arnold Arboretum in favorable positions but needs protection while young. Its chief ornamental value consists in the handsome foliage turning orange and scarlet in fall and in the bright red frs. Wood and bark are exceedingly bitter. The wood of some species, especially *P. excelsa*, Planch., from W. Indies, is used in medicine like that of Quassia.

ALFRED REHDER.

PIE-PLANT: *Rhubarb*.

PIERIS (a mythological name). Including *Portia*. *Ericaceæ*. Ornamental shrubs, grown chiefly for their handsome white flowers.

Evergreen or deciduous shrubs or rarely small trees: lvs. alternate, short-petioled, entire or serrulate: fls. in often paniced racemes or in axillary clusters forming terminal racemes; calyx-lobes valvate or distinct; corolla globose or urceolate, with 5 short lobes; stamens 10; anthers obtuse, with a pair of awns near the base or the filaments 2-toothed below the apex: caps. with 5 dehiscent valves; seeds linear-oblong, not winged, with membranaceous testa.—About 10 species in N. Amer. and in E. Asia south to the Himalayas. Often included under *Andromeda*. Closely allied to *Lyonia*, which is distinguished by its awnless anthers, and to *Zenobia*, which has the anthers 4-awned at the apex. The foliage of some species is said to be poisonous to cattle.

The pieris are handsome shrubs with medium-sized oval to lanceolate leaves and with rather small white flowers in large terminal panicles or in racemes. The evergreen *P. floribunda* and the deciduous *P. mariana* are hardy North and, like the other species, are valuable for the earliness of their flowers. The most beautiful are *P. japonica* and *P. formosa*; the first thrives still in Massachusetts in sheltered positions, but the flowers are usually winter-killed, while *P. formosa* can be grown only South. They are easily forced, and *P. japonica* especially may be recommended for this purpose; it makes a very handsome and graceful pot-plant for

inside decoration with its slender racemes of pure white flowers hanging over the glossy bright green foliage. The species of *Pieris*, like other *Ericaceae*, grow well in a moderately moist well-drained and porous soil, but dislike limestone and heavy clay; a partly shaded situation suits them best. Propagation is by seeds treated like those of azalea or rhododendron; also by layers, and the evergreen kinds by cuttings of almost ripened wood in August under glass, kept during the winter in a cool greenhouse. They root very slowly; cuttings taken from forced plants root more readily.

A. Lvs. evergreen.

B. Fls. in terminal panicles formed the previous year and remaining naked during the winter: lvs. serrulate.

C. Panicles upright. floribunda, Benth. & Hook.

(*Andrōmeda floribunda*, Pursh. *Portūna floribunda*, Nutt.). Fig. 2945. Dense shrub, 2-6 ft. high: branches and petioles with strigose brown hairs: lvs. ovate to oblong-lanceolate, acute, minutely serrulate and setosely ciliate, otherwise glabrous, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long: fls. nodding, in terminal dense upright panicles $1\frac{1}{2}$ -4 in. long; corolla ovate, strongly 5-angled, white, $\frac{1}{4}$ in. long. April, May. Va. to Ga., in the Alleghany Mts. B.M. 1566. B.R. 807. G.C. III. 45:408. Gn. 31, p. 612. Gn.M. 6:280. Mn. 5, p. 132. M.D.G. 1898:333.—Very desirable evergreen shrub for its hardiness and earliness of the fls.

cc. Panicles drooping.

japōnica, D. Don (*Andrōmeda japōnica*, Thunb.). Fig. 2946. Shrub, with spreading branches or sometimes small tree to 30 ft.: branches glabrous: lvs. crowded at the ends of branches, obovate-lanceolate or oblanceolate, crenately serrulate, narrowly cuneate at the base, glabrous, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long: fls. in pendulous panicles, $2\frac{1}{2}$ -5 in. long; corolla ovate, not angled, $\frac{1}{4}$ in. long. April, May. Japan. R.B. 11:10. B.H. 21:19. Gn. 12:98, and p. 424; 50, p. 307; 57, p. 399. G.C. II. 17:797. M.D.G. 1898:544. G.W. 9, p. 354. J.H. III. 51:109. G.M. 55:199. G. 24:141; 27:182; 31:593. S.I.F. 1:78. Var. *albo-marginata*, Rehd. Lvs. with whitish margin and smaller. Var. *pygmaea*, Maxim. Dwarf form with small linear-oblanceolate lvs. Japanese botanists speak of a variety with the racemes a foot and more long; this form seems to be not yet intro. *P. japonica* is one of the most graceful early-blooming evergreens.

formōsa, D. Don (*Andrōmeda formōsa*, Walt.). Shrub or small tree, to 20 ft.: branchlets glabrous: lvs. crowded at the end of the branchlets, elliptic-oblong to lanceolate, acuminate, broadly cuneate at the base, finely serrulate, glabrous, lustrous above, 2-5 in. long: fls. in terminal drooping or spreading panicles, to 6 in. long; corolla urceolate, white or tinged with pink, $\frac{1}{4}$ in. long. April, May. E. Himalayas. B.M. 8283. G.C. II. 15:569. Gn. 54, p. 77. G. 27:183; 35:425, 427. I.H.



2945. *Pieris floribunda*. ($\times\frac{1}{2}$)



2946. *Pieris japonica*. ($\times\frac{1}{2}$)

5:162.—Very similar to the preceding species, but larger in every part; less hardy.

BB. Fls. in axillary clusters, forming terminal leafy racemes: lvs. entire.

lūcida, Rehd. (*P. nitida*, Benth. & Hook. *Andrōmeda lūcida*, Jacq. *A. nitida*, Bartr. *A. coriacea*, Ait. *Lyōnia nitida*, Fern. *L. lūcida*, Koch). FETTER-BUSH. Shrub, 2-6 ft. high, with triangular branches, quite glabrous: lvs. obovate or broadly elliptic to oblong, narrowed at both ends, bright green and shining above, entire and slightly revolute at the margin, $1\frac{1}{4}$ -3 in. long: corolla cylindric-ovate, white to pink, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: caps. ovoid-globose, with ridges at the sutures. March-May. N. C. to Fla. and La. B.M. 1095. Var. *rūbra*, Rehd. (*Andrōmeda coriacea rūbra*, Lodd.). Fls. deep pink. L.B.C. 7:672.

AA. Lvs. deciduous or half-evergreen, entire: fls. in racemes.

marīana, Benth. & Hook. (*Andrōmeda marīana*, Linn. *Lyōnia marīana*, D. Don. *Leucothōe marīana*, DC.). STAGGER-BUSH. Fig. 2947. Deciduous shrub, 2-4 ft. high, glabrous or nearly so: lvs. oval to oblong, obtuse or acute, usually cuneate at the base, entire, 1-3 in. long: fls. nodding, in axillary clusters on leafless branches of the previous year, forming 2-5 in.-long racemes; corolla cylindric-campanulate, white or pale pink, almost $\frac{1}{2}$ in. long: caps. ovate-pyramidal. April-June. R. I. to Fla. B.M. 1579. Mn. 2:47. G.O.H. 113. A.G. 10:281 (adapted in Fig. 2947).—The foliage is said to poison lambs and calves.

ovalifolia, D. Don (*Andrōmeda ovalifolia*, Wall.). Half-evergreen or deciduous shrub or tree, to 40 ft.: branchlets glabrous: lvs. coriaceous, ovate or elliptic to ovate-oblong, short-acuminate or acute, usually rounded at the base, glabrous or hairy on the veins beneath, 2-6 in. long: fls. in simple lateral racemes with a few lvs. at the base, 2-6 in. long; sepals ovate to triangular-lanceolate; corolla oblong-urceolate, white, slightly pubescent outside, $\frac{1}{4}$ in. long. May-June. Himalayas. Var. *lanceolata*, Clarke (*P. lanceolata*, D. Don). Lvs. elliptic-oblong to elliptic-lanceolate, narrowed at the base, smaller: sepals greenish, oblong to lanceolate. Himalayas, China. Var. *elliptica*, Rehd. & Wilson (*P. elliptica*, Sieb. & Zucc.). Lvs. thinner,

deciduous, elliptic-ovate to ovate-oblong. Japan, China. S.I.F. 2:60. This variety is harder than the type.

P. phillyreafolia, DC. Evergreen shrub, 1-2 ft., glabrous: lvs. oblong, serrulate near the apex, 1-2 in. long: racemes axillary, 4-12-fld.; corolla ovoid, white. Feb., March. W. Fla. B.R. 30:36. H.I. 2:122.

ALFRED REHDER.

PIGAFETTA (derivation not known). *Palmaceae*. Tall palms: sts. stout, aculeate above, remotely annulate below, creeping at base: lvs. terminal, pinnately

divided; segms. opposite and alternate, lanceolate, acuminate; spadix paniculate, much branched, pendulous; fls. polygamous-monoecious; male calyx obconic, truncate or obscurely 3-toothed; petals 3, free, lanceolate, valvate; stamens 6, filaments short, thick; ovary an inconspicuous rudiment: fr. globose or oblong, 1-celled. About 5 species, Malaya. *P. elata*, Wendl. (*Hyospathe elata*, Hort. *Metrazylon elatum*, Mart.). Trunk of very hard wood, erect, naked; lvs. spreading



and drooping, similar to those of *Cocos*; petioles thick and having long bristles which become spiny with age; infl. long, spadices with pendulous branches: fr. with a solitary blackish seed. Celebes. Cult. occasionally abroad; for treatment, consult article *Palm*.

PILEA (*pileus*, a Roman cap: one of the segments of the perianth in the first described species covering the achene). Syn., *Adicea*. *Urticaceae*. Mostly weedy plants, but forms of one or two species are grown in greenhouses for their compact fern-like sprays and for the interesting phenomenon of forcibly discharging the pollen, whence the name "artillery plant."

Annual or perennial herbs, glabrous or pubescent: lvs. opposite, usually strongly 3-nerved; fls. monoecious or dioecious, mostly very small and in axillary clusters; stamens 3-4, and the sepal-lobes in the staminate fls. of the same number; sepal-lobes of pistillate fls. 3, the ovary 3-angled and erect and bearing a sessile tufted stigma, with 3 scale-like staminodia: fr. an achene, ovate or nearly orbicular, compressed, more or less invested in the perianth.—There are 150 or more species of *Pilea* in the tropics, chiefly of Amer., and few extra-tropical; one, *P. pumila*, is a small nettle-like but stinging plant growing in the northern states.

The artillery plants of the gardens are small branchy half-succulent herbs, usually grown in pots and allowed to reach a foot or so in height. The gracefully curving fronds of small ovate or obovate shining leaves are much prized. They are easy to grow, being propagated by cuttings. They thrive best when given an abundance of water. Sometimes they are used as edgings in

orchid houses, to screen the pots with green, and they also tend to equalize the moisture conditions and thereby contribute to the welfare of the orchids. When the staminate flowers open, the pollen is usually discharged forcibly and visibly. If a plant is put in a sunny place when the pollen is ripe, it may set up a vigorous bombardment, particularly if the foliage is sprayed. (See I.H. 1, p. 64, 1854, for an account of this phenomenon.) The artillery plant is seen in nearly every greenhouse, but whether there is more than one species in common cultivation it is not easy to determine, for specific characters are difficult to draw. The leaves, although opposite, are unequal. Usually the branchlets develop alternately on the branch. The species are confused.

muscosa, Lindl. (*P. microphylla*, Liebm.? *P. callitrichoides* of some authors). Monoecious: small, rather weak plant: lvs. less than $\frac{1}{4}$ in. long as a rule, sometimes very small: fl.-clusters mostly sessile or nearly so. Mex., W. Indies, S. Amer.—Whether the plant in cult. is really the *P. muscosa* originally described by Lindley is in question. The plants are variable and characters apparently not well understood. *P. microphylla*, Liebm., is reported in Fla.

serpyllifolia, Wedd. (*P. muscosa*, Hort., in part. *P. callitrichoides* of some). Fig. 2948. Dioecious: plant usually stronger and more upright: lvs. usually $\frac{1}{4}$ in. or more long, and fl.-clusters more peduncled. Mex.—Seems to be the commoner species, but it is difficult to determine them.

L. H. B.

PILOCÁRPUS (Greek, *pilos*, a cap, and *karpos*, a fruit, from the shape of the fruit). *Rutaceae*. Shrubs or small trees, sometimes attaining 10 feet.

Leaves pinnately compound, of 1-4 pairs and a terminal lft.; lfts. opposite, but the lvs. usually alternate: fls. in elongated racemes; petals 4-5, valvate; stamens 4-5; ovary 4-5-lobed, not tubercled.—Seventeen species, natives of Trop. Amer., principally Brazil. The plants of the genus form the source of the alkaloid "pilocarpine," and together with plants of several other genera, the source of the drug "jaborandi."

pennatifolius, Lem. Branchlets glabrous or puberulent: lvs. alternate, 1-1 $\frac{1}{2}$ ft. long; lfts. 2 or 3 pairs, besides the terminal one, 3-9 in. long, oblong; apex rounded or emarginate, coriaceous, yellowish green:



raceme spike-like, many-fld. (about 100): rachis stout, pedicels stout, horizontal, with 2 small greenish tooth-shaped bracts at their bases: fls. reddish brown, rotate. Brazil. B.M. 7235. J.F. 3:263.—Intro. into Calif. and said to be hardy in the open wherever the lemon can be successfully grown.

racemosus, Vahl. A small tree or shrub, 6-15 ft. high: lfts. 1-5, lance-elliptic to oval or obovate, retuse at the apex, cuneate or somewhat rounded at the base,

entire, coriaceous, pellucid-punctate: petals ovate or oblong-ovate, acute; filaments subulate: fr. a dark brown or blackish follicle; seeds glabrous. W. Indies. —Intro. into Calif.

P. Jaborandi, Holmes, has been described as *P. pennatifolius*, by Benth. & Trim., but is distinguished from it by shorter lvs. and lfts., stiffly pubescent branchlets and sta., more openly fld. racemes, with slender rachis and pedicels, and the presence of 2 inconspicuous bracteoles above the middle of the fl.-pedicels. B.M. 7483.

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F. TRACY HUBBARD.†

PILOCÈREUS of the "Cyclopedia of American Horticulture" is mostly *Cephalocereus*. *P. Celsianus* = *Oreocereus*. *P. chrysomallus* and *P. Columna-Trājani* = *Pachycereus*. *P. Dautwitzii* = *Oreocereus*. *P. Houlettii*, Auth. = *Cephalocereus Sartorianus*. *P. Schottii* = *Lophocereus*. *P. Strausii* = *Oreocereus Celsianus*.

PILÓGYNE: *Melothria*.

PILULÁRIA (Latin, a little ball, alluding to the shape of the involucre). *Marsileaceae*, one of the fern allies. Small aquatic plants, sometimes used in ponds: rootstock filiform, creeping, rooting at the nodes: barren fronds reduced to filiform stipes, few or clustered at the nodes: involucre solitary at the nodes, sessile or shortly stipitate, globular: sori 2-4, vertically adnate. —About 6 species, Eu., W. Asia, Austral., New Zeal., and N. Amer.

globulifera, Linn. Rootstock creeping under water, often to a considerable extent: barren fronds filiform, bright green, like the lvs. of *Isoetes*, 1-3 in. long, usually few together at the nodes: involucre about the size of a pea, slightly hairy, sessile or borne on very short erect or recurved stipes. Eu., W. Asia, and Austral.

PILÚMNA: *Trichopilia*.

PIMÉLEA (Greek, fat, referring to the fleshy seeds). *Thymelæaceae*. RICE-FLOWER. Mostly shrubs, fitted for greenhouse culture, although reported to be hardy in the open wherever the lemon can be grown successfully.

Woody, or rarely herbaceous, with small opposite or alternate, always simple and entire lvs.: infl. usually a terminal head or cluster, never umbellate, often with an involucre of 4 or more bracts at the base: fls. hermaphrodite or functionally dioecious, white, pink or reddish, small but showy in the clusters and the bracts are often colored; perianth tubular, with a spreading (rarely erect) 4-lobed limb, the throat sometimes folded or thickened but without scales; stamens 2, inserted in the throat opposite the 2 outer perianth-lobes; ovary 1-celled: fr. a small drupe, included in the base of the perianth. —Austral. and New Zeal. Of the 80 or more species, only 3 or 4 (as *P. ferruginea*, *P. ligustrina* and *P. spectabilis*) are much known in cult. here, but there are other very showy species, some of which are grown in the Old World.

These fine evergreen shrubs may be increased readily from cuttings of the young half-ripened shoots in March. Make these cuttings 2 to 3 inches long and place in pans, leaving about an inch between the cuttings. The pans should be filled with a mixture of loam, peat and silver sand in equal parts. See that the pans are well drained. Place where they may have a temperature of 55° to 60° and keep covered with glass. See that they are shaded and moist, and they will soon root. When they have made a fair amount of roots, they may be potted up into small pots, using a mixture of fibrous loam, fibrous peat, and leaf-mold in equal parts, with enough of sand to keep the compost open. Be sure that each pot has plenty of drainage as this is necessary for their welfare. They should be grown in a house where they will get a fair amount of ventilation in the summer and be shaded. The atmosphere should be kept moist by damping down, and the plants should have a good syringing every bright day. In the summer they should

have the tops pinched. The pots may be placed on ashes, and this will help to keep them moist. They are slow-growing plants, and therefore will need but one shift during the summer. When they have filled the pots with roots, they may be shifted into 3- or 4-inch pots, using the same mixture. When the autumn comes, they should be given more ventilation, to ripen up whatever wood they have made. In autumn they may have a temperature of about 50° at night with about 10° rise with sun heat. They will do well in about 45° for a winter temperature, with about 55° to 58° on bright days. In winter, give great care to watering so they will not become too wet, just keeping in a nice moist state. By February they may have any necessary potting, using a mixture of fibrous loam four parts, fibrous peat one part, leaf-mold and well-decayed cow-manure one part each, and enough clean sharp sand to make it porous. Pot firmly. They may now be given a temperature of 50° during the night with about 65° on bright days and by April they should be standing 5° to 8° more. They will now need a shift into 5- or 6-inch pots, and give them a pinch back when they have made a little growth. In summer they may have the strongest growths tied out in a horizontal position. Give the same culture as advised for the previous summer and by the next spring the plants should flower. For established plants, they will require heading in after they are through flowering and encouraged to make growth freely during the summer. Give these plants plenty of syringing as they are liable to be affected with red-spider; their treatment year after year will be similar to that mentioned before, only with larger shifts and to be assisted by weekly applications of liquid manure to give them renewed vigor. (J. J. M. Farrell.)

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A. *Involucral lvs. absent.*

1. *longiflora*, R. Br. Sts. 4 ft. or more high, slender, erect, very leafy: lvs. sometimes alternate, linear, hairy: fls. pure white, hairy externally, long and slender; heads globose, many-fld.; perianth silky; anthers yellow, not exserted. W. Austral. B.M. 3281.

AA. *Involucral lvs. reduced to 2 small bracts.*

2. *drupacea*, Labill. A straggling shrub 6-8 ft. high or lower: branches leafy: lvs. ovate to oblong-elliptical or oblong-linear, glabrous above, slightly silky hairy beneath, distinctly penniveined: fls. white or tinged with pink, silky hairy; anthers yellow, hardly exserted: heads sessile, few-fld.: fr. a red or black drupe. Victoria, Tasmania. L.B.C. 6:540.

AAA. *Involucral lvs. 8, or usually more than 8.*

3. *imbricata*, R. Br. Small erect shrub, much branched, from less than ½-1½ ft. high, usually clothed with long, silky hairs, but sometimes glabrous: lvs. usually crowded, alternate or opposite, oblong-lanceolate to linear; involucral lvs. similar to stem-lvs., much shorter than fls.: fls. white, outside hairy; tube cylindrical, heads terminal, globular, many-fld. W. Austral. B.M. 3833 (as *P. nana*, and which is included under var. *piligera* in Fl. Austral.).

AAAA. *Involucral lvs. 4-8.*

B. *Lvs. distinctly penniveined.*

c. *Fls. white.*

4. *hypericina*, A. Cunn. St. erect, slender, to 8 or 10 ft. high: branches not very leafy: lvs. opposite,

elliptic-oblong, smooth: fls. white, hermaphrodite and female on distinct plants, very hairy externally; hermaphrodite fls. longer and more slender: heads many-fld. and crowded.—Very similar to *P. ligustrina*, in fact placed as a variety of it in *Flora Australiensis*; distinguished in having more involucrel lvs. much shorter than the fls. and silky pubescent or hoary. Austral. B.M. 3330.

5. *ligustrina*, Labill. Erect, 5–6 ft. high: lvs. opposite, ovate to oblong or elliptical; involucrel lvs. 4, very rarely 5 or 6, as long as the fl.-tubes, glabrous: fls. sometimes female only, silky hairy, white, in rather large globular heads. Austral., Tasmania. B.R. 1827.

cc. Fls. rose-colored or yellowish.

6. *suavæolens*, Meissn. Erect, often less than 1 ft. high, sometimes branching at base only, reaching 2–3 ft.: branches very leafy: lvs. opposite, ovate-lanceolate to oblong-linear; involucrel lvs. 4–8, usually as long as the fls. and ciliate: fls. yellowish when fresh, usually hairy; heads globular, very large and many-fld. W. Austral. B.M. 4543 (as *P. macrocephala*).

bb. Lvs. not penniveined or very obscurely so.

c. Color of involucrel lvs. green.

d. Fls. white.

7. *glauca*, R. Br. (*P. humilis*, Lindl., not R. Br. *P. intermedia*, Lindl.). Erect, much branched, $\frac{1}{2}$ –1½ ft. high, glabrous below: lvs. opposite, ovate to oblong-lanceolate or almost linear, small and short; involucrel lvs. usually 4, shorter than fls.: heads globular, not many-fld., the fls. silky-hairy, white. Austral. and Tasmania. L.B.C. 17:1611. B.R. 1268, 1439.

8. *linifolia*, Smith (*P. filamentosa*, Rudge. *P. involucrata*, Banks. *P. paludosa*, R. Br.). Erect, 1–3 ft. high: branches slender, bark ferruginous, not very leafy: lvs. opposite, very short-petioled, linear-lanceolate to linear or oblong; involucrel lvs. 4, nearly as long as fls.: heads terminal, globular, erect, bearing white fls. Austral., Tasmania. B.M. 891. L.B.C. 17:1668.

9. *graciliflora*, Hook. Erect, slender, 2½ ft. high: lvs. lanceolate, dotted above; involucrel lvs. 6, shorter than fls.: fls. long, slender, glabrous.—Very similar to *P. sylvestris*, and described as the same in Fl. Austral.: distinguished from it by narrower lvs. dotted above, and more slender pure white fls. B.M. 3288.

10. *arenaria*, A. Cunn. Small, erect shrub, dichotomously branched, to 2½ ft.: lvs. opposite, ovate, obscurely downy above, silky hairy beneath; involucrel lvs. not different from st.-lvs.: fls. silky on outside, white; anthers and style not protruded beyond perianth-tube: heads few-fld. and sessile. New Zeal. B.M. 3270.

dd. Fls. mostly rose-colored (varying to whitish and bluish).

11. *rosea*, R. Br. Erect, small: branches sparsely leafy: lvs. opposite, linear-lanceolate or linear, glabrous both sides, margins revolute; involucrel lvs. 4, as long as fls., ciliate on margins: fls. pink or whitish, with long spreading hairs on lower portion of tube, silky on upper portion. W. Austral.—Very closely allied to *P. ferruginea*, but fls. larger and bracts more acuminate. B.M. 1458; 3721 (as *P. Hendersoni*). L.B.C. 1:88.

12. *sylvestris*, R. Br. Shrub, 2–3 ft. high, copiously branched: lvs. opposite, lanceolate or oblong-lanceolate, glaucous; involucrel lvs. 4–6, smaller than st.-lvs., shorter than fls.: fls. quite glabrous, bluish, in globular heads; stamens and style very much protruded: heads large and many-fld. W. Austral. B.M. 3276. B.R. 1582. L.B.C. 20:1965.

ddd. Fls. white and pink in same head.

13. *nivea*, Labill. (*P. incana*, R. Br.). Erect, bushy or straggling, 6 ft. or more high: branches and under

side of the lvs. white, with a dense tomentum: lvs. ovate or orbicular, glabrous above; involucrel lvs. 4–6, larger than st.-lvs.: fls. white or pink, tomentose or silky: heads globular, terminal, many-fld. Tasmania. B.R. 24:24. F.C. 1:9.

cc. Color of involucrel lvs. pink or red, or tinged only at margin.

14. *ferruginea*, Labill. (*P. decussata*, R. Br. *P. diosmifolia*, Lodd. *Heterolena decussata*, C. A. Mey.). Short much-branched shrub, 1–3 ft. high: lvs. opposite and usually crowded, ovate or oblong, firm, with margins revolute; involucrel lvs. 4, orbicular, glabrous, shorter than the fls.: heads terminal, globular, rose-colored; fls. hairy, lower portion hispid, upper silky. W. Austral. L.B.C. 13:1283; 18:1708. B.M. 8574.

15. *spectabilis*, Lindl. Erect, 3–4 ft. high, glabrous: lvs. crowded, mostly opposite, linear-oblong or lanceolate; involucrel lvs. 4–6, ovate or ovate-lanceolate, half as long to nearly as long as the fls., usually tinged only at margins: fls. white after expansion, hairy outside: heads very large, globular, many-fld. W. Austral. B.R. 27:33. B.M. 3950. R.B. 26:157. G.W. 3, 414. F.E. 16:610.—A very handsome, showy plant, now probably the most popular species.

16. *spathulata*, Labill. (*P. cernua*, R. Br.). Much branched, 2–3 ft. high: lvs. linear to linear-oblong; involucrel lvs. ovate, glabrous, sometimes not colored: fls. silky hairy, much resembling *P. linifolia*: heads large, globular, many-fld. and nodding. Austral., Tasmania. F.C. 2:72. ARNOLD V. STUBENRAUCH. L. H. B.†

PIMENTA (from the Spanish *pimento*, allspice). *Myrtaceæ*. Highly aromatic trees, one species of which is the allspice.

Leaves large, leathery, feather-veined, long-stalked, black-dotted beneath: fls. numerous, small, white; borne in terminal or axillary, trichotomous cymes; calyx-tube top-shaped; petals 4–5; stamens numerous: drupe 1–2-seeded.—Five or six species, native of Trop. Amer. As a genus *Pimenta* is distinguished from its near allies (*Eugenia*, *Myrtus*) by the circular or spiral embryo and the 2-celled ovary with 1–6 ovules pendulous from the apex of each cell.



2949. Allspice.—*Pimenta officinalis*. (×¼)

Allspice is the unripe berry of *P. officinalis*, which is gathered and dried in the sun. Its name comes from the idea that allspice combines the flavors of clove, cinnamon, and nutmeg. Allspice is common in the wild in Jamaica, inhabiting limestone soil. It is more extensively cultivated or run wild in Jamaica than anywhere else. It is cultivated up to 4,000 feet. The plant is not



2950. Flowers of allspice. (X2)

offered in the American trade, but there seems no reason why it could not be cultivated in Porto Rico.

officinalis, Berg. (*Eugenia Pimenta*, DC.). ALLSPICE. PIMENTO. Figs. 2949, 2950. Distinguished from the other species by the oblong lvs., 4-lobed calyx and globose drupe. Tree, 30-40 ft. high: lvs. 2-6 in. long; petiole $\frac{1}{2}$ in. long; fls. 3 lines long; drupe 3 lines thick. Cuba, Jamaica, Mex., Cent. Amer. B.M. 1236 (as *Myrtus Pimenta* var. *longifolia*).

P. acris, Kostel., the bayberry or bay-rum tree is by some separated in the genus *Amomis* (*A. caryophyllata*, Krug & Urb.), a shrub or small tree in the W. Indies, Venezuela, and Guiana, from the dried lvs. of which (and probably also from other myrtaceous plants) the bay oil or oil of myrica is distilled: bark separating in shreds or plates: lvs. shining above, very aromatic.

L. H. B.

PIMPERNELL: *Anagallis*.

PIMPINÉLLA (possibly from Latin *bipinnula*, bipinnate). *Umbelliferae*. About 75 species of herbs, one of which has been described under *Anise*. *P. integerrima*, Gray (see *Tanidia*), has been offered by one dealer in hardy native plants. It differs from *Anise* in being a perennial plant with lvs. 2-3-ternate and segms. entire. B.B. 2:526. *P. major*, Huds. (*P. magna*, Linn.). Sts. 1-2 ft., angularly striate: lvs. pinnate, lfts. all ovate-serrate, somewhat cut, the terminal one 3-lobed. Eu. Probably not in cult., but a form listed as *P. magna rosea*, Hort., with rose-colored fls. is cult. in England as a border and rock-work plant.

PINÁNGA (Malay name). *Palmaceae*, tribe *Areceae*. Slender spineless bamboo-like palms from India and the Malay Archipelago.

Stems erect: lvs. terminal, unequally lobed or pinatisect, or simple and bifid at the apex; segms. plicate, many-nerved, the lower ones acuminate, the upper confluent, the margins not thickened, recurving at the base; rachis acute above, convex below; petiole convex above; sheath elongated: spadix usually small, very simple: peduncle short: branches in groups; spathe 1, symmetrical, swollen or compressed and 2-winged: fls. rather small, the staminate one on each side of a pistillate, thus differing from *Areca* in which the pistillate fls. are solitary: fr. ovoid or elliptical, orange or red, with a membranous husk.—About 40-50 species. For cult., see *Palms*.

Kühlil, Blume. Fig. 2951. Sts. tufted, 20-30 ft. high, slender: lvs. 3-4 ft.; lfts. many, 1-2 ft., falcate-linear to linear-lanceolate, finely acuminate, strongly 2-3-ribbed, upper confluent; petiole variable in length, somewhat scurfy: fr. $\frac{1}{2}$ in. long, shortly apiculate. Sumatra, Java. G.C. III. 31:104. G.W. 12, p. 209. Known also as *Ptychosperma* and *Seaforthia Kühlil*.

gracilis, Blume (*Areca gracilis*, Roxbg.). Sts. 6-20 ft. high, 3-4 lines diam., thickening upward, usually gregarious: lvs. 3-4 ft. long, sparingly pinnate; petiole and sheaths scurfy; lfts. inserted by a very broad base, 1 ft. or more long, the lower ones 2-3-ribbed, finely acuminate, the upper 3-5 in. wide, many-ribbed: fr. $\frac{1}{2}$ in. long, scarlet or orange, smooth, tapering to the tip. Himalayas, Burma.

P. maculata, Porte. A dwarf slender palm with apparently permanently variegated lvs.: lvs. elliptic, bifid nearly to the middle: spadix below the lvs., recurved: fls. showy, scarlet. Philippine Is. B.M. 8011. Not in cult. in Amer.—*P. malaidna*, Scheff. St. slender, 8-12 ft. high: lvs. 5-8 ft. long; lfts. numerous, linear acuminate: spadix 6 in. long, blood-red in fr.: fr. 1-1 $\frac{1}{2}$ in. long, blackish purple. Malaya.—*P. Micholitzii*, Hort. Sander is a plant exhibited at Ghent in 1908, from Sumatra. G.C. III. 43:259.—*P. ternatensis*, Scheff. (*Areca gigantea*, Hort.) Lvs. 12 ft. long, with 30-40 lanceolate segms., the largest 3 ft. long: branches of spadix spirally disposed. Ternate Isl.

N. TAYLOR.†

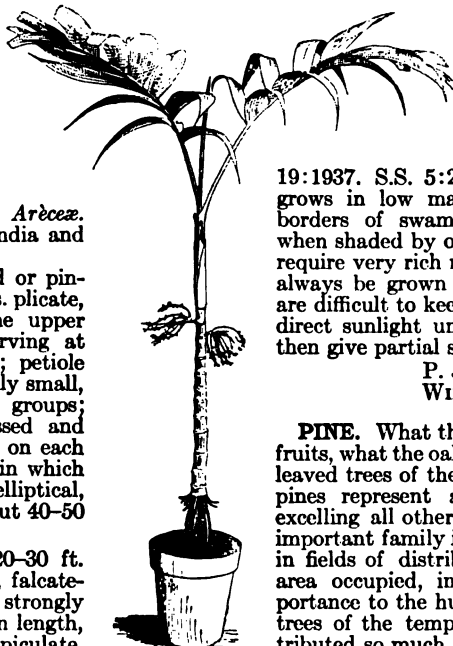
PINCKNEYA (Charles Cotesworth Pinckney, of South Carolina, 1746-1825, distinguished statesman and general of the American Revolution). *Rubiaceae*. This includes the fever tree or Georgia bark, a tall shrub or small tree with fls. in large terminal or axillary cymes, native to the marshy banks of streams in the pine barrens from S. C. to Fla. Its showy fl.-cluster attains a breadth of 4 in. and depth of 3 in., with as many as 20 fls., each 1 in. long, tubular, white, speckled red, with 5 revolute lobes. But the distinctive feature of the fever tree, both botanically and horticulturally, is the presence of 5 or more large showy colored floral lvs. These are 2 in. long, 1-1 $\frac{1}{2}$ in. wide, oval or roundish, acute, narrowed at the base, and peach-yellow margined with rosy red. The interesting feature of these floral lvs. is that they are not bracts, but modifications of one of the calyx-lobes, which are normally small and awl-shaped. Only one other species of this genus is described, *P. ionantha* from Colombia. The fever tree has been cult. in Eu. under glass, but it is rarely successfully cult. in Amer.

pubens, Michx. **GEORGIA BARK. FEVER TREE. BITTER BARK.** Attains 25 ft.: lvs. oval or oblong, acute, 4 x 1 $\frac{1}{2}$ in.; midrib rosy: calyx 5-lobed; lobes deciduous or one of them in the outer fls. often transformed into a showy floral lf.; corolla hairy; stamens 5, exserted, stigma obtuse: caps. globose, papery, 2-celled; seeds numerous, in 2 rows, horizontal, winged. F.S.

19:1937. S.S. 5:227, 228.—*P. pubens* grows in low marshy woods and on borders of swamps. It thrives best when shaded by other trees. Seedlings require very rich moist soil and should always be grown under shade. They are difficult to keep alive if exposed to direct sunlight until 4 or 5 feet high; then give partial shade.

P. J. BECKMANS and
WILHELM MILLER.

PINE. What the apple is among the fruits, what the oak is among the broad-leaved trees of the temperate zone, the pines represent among the conifers, excelling all other genera in this most important family in number of species, in fields of distribution, in extent of area occupied, in usefulness and importance to the human race. No other trees of the temperate zone have contributed so much to the building up of civilization, and no other, it may be predicted, will continue longer to fill



2951. *Pinanga Kühlil*.

the important place in the household of civilized men; for not only do they furnish in a number of species the most satisfactory qualities of wood for structural purposes, but their frugality in regard to soil conditions will preserve them a place as wood-producers in many of the poor sites, when the lands fit for agricultural use have all been turned over to food-production.

Among the seventy or more well-distinguished species—over 600 species and varieties of *Pinus* have been described—all inhabitants of the northern hemisphere, ranging from the arctics through plains and mountains to near the equator, occurring in the tropics at least on high mountains, a variety of adaptation, of form, of usefulness, may be found to satisfy every requirement; and since more than half the number of species (about forty) are indigenous to North America or the United States, it is hardly necessary to go out of this general region for plant material.

For economic importance, as well as for a combination of points of excellence in all directions, ornamental as well as useful, rapidity and quantity of production and adaptability to climate and soil, the chief place belongs to the white pine (*P. Strobus*), and next in importance stands the longleaf pine (*P. palustris*) of the southern states. The red pine (*P. resinosa*), the shortleaf (*P. echinata*), the Loblolly (*P. Taeda*), with the Cuban pine (*P. caribaea*), add their stores to the enormous quantities furnished annually by the first and second. In the western mountains the bull pine (*P. ponderosa*), the sugar pine (*P. Lambertiana*), and the silver pine (*P. monticola*) are very large timber pines; and in Mexico *P. Ayacahuile* replaces the white pine, and *P. arizonica* and *P. montezumae* are the important yellow pines. In the Philippine Archipelago one species, *P. insularis*, forms important mountain forests. In Europe the Scotch pine (*P. sylvestris*) furnishes the bulk of supplies, with *P. nigra* in the more southern countries. In Japan and northern China *P. densiflora* and *P. Thunbergii* and in the Himalayas *P. excelsa* and *P. longifolia* are the important species.

Besides the timber, several of the species furnish from their resinous contents naval stores, turpentine, tar, and pitch, the bulk of which is now still derived from the native longleaf pine. Pine wool is made from the leaves of this and other species, essential oils are distilled from leaves and young shoots and used medicinally, and the seeds of the nut pines are used for food and flavors. While the economic importance of the genus can hardly be overrated, the ornamental value is undoubtedly less than that of other genera like the spruces and firs. Nevertheless, at least interest and picturesqueness, if not beauty and symmetry of form, attach to a large number of species.

Choice of material for planting with such a wealth of species is difficult; yet climatic limitations reduce the number that may be grown within each climatic zone, and further assistance in the choice may be found in the fact that the botanical division of the species into three groups; viz., white pines, yellow pines (so called from the color of the wood), and nut pines, denotes at the same time differences of habit and form.

In no other group, perhaps, is it so necessary to keep in mind that form and habit change through the different periods of life from the juvenile through the adolescent to the virile and senile stages of development; while symmetrical and pleasing in their youth and grand or picturesque in their age, in their intermediate stages the trees may be straggling and unsightly. Starting in its youth with the pyramidal aspiring habit of all the conifers, the shaft dominating over the branch system and the latter surrounding the former in regular whorls, later on the symmetry is disturbed and finally the towering old pine may have its bole split up into many stout branches and the crown may have broadened and flattened or rounded off in the umbrella-like fashion which the stone pine (*P. Pinea*) exhibits so strikingly

in the Italian landscape. This flattening of crown is characteristic of most yellow pines, while the pignons or nut pines have a tendency to the broom-like or apple-tree appearance. Of the eastern species, the white pines alone preserve to some extent the conical habit of the crown in imitation of the spruces with more or less symmetrical horizontally spreading branches, which render them pleasing objects throughout all periods of life. On the Pacific Coast a number of species preserve the conical form.

In the choice and combination of plant material it should be kept in mind that the pines are essentially light-needing species, hence do not bear overtopping or crowding unless they have a chance by their rapid growth in height to escape from the pressure of their shade-making neighbors; the white pines, especially *P. Strobus* with its denser foliage, are more tolerant of shade than others; the dwarf *P. montana* is also tolerably shade-enduring.

In each of the three groups there are rapid growers (in height) and slow growers, although all are slow during the first two to seven years.

The common white pine (*P. Strobus*) and the Cuban pine (*P. caribaea*), with the European, Scotch, and Austrian pines, are good examples of the first class, making under favorable conditions annual shoots of 1 to 2 feet for a number of years; while the Swiss stone pine (*P. Cembra*) and other pines of high altitudes, like *P. flexilis* and *P. albicaulis*, are examples of slow growers. There are persistent growers reaching great heights, and laggards, remaining dwarfs or medium-sized trees; again the king of pines, the common white pine, and its giant congener the sugar pine, with the bull pine in favorable situations, take first rank, the first with a maximum height of 160 feet and more, the last with over 200 feet, while many of the so-called scrub pines, like *P. virginiana*, *P. serotina*, *P. Banksiana*, the Alpine white pines, *P. flexilis*, *P. aristata*, *P. Peuce*, *P. pungens*, *P. densiflora*, and most nut pines reach rarely over 40 feet; some, like *P. koraiensis*, *P. Bungeana*, *P. montana*, with several of the nurserymen's varieties, remain actually dwarfs and maintain a compact bush-like appearance for a long time.

In regard to foliage, quite a large variety can be secured. For grace and elegance nothing better again than the five-needled silver-lined white pine can be suggested, although *P. excelsa* from the Himalayas, with its slenderer and longer branches and more drooping foliage, and the dwarfs *P. Peuce* from Macedonia and *P. koraiensis*, with their denser and more compact crowns, and some others of the white pine tribe, may vie with it. Among the yellow pines, the native almost entirely overlooked, *P. glabra*, deserves mention in this connection, where the climate permits its use, as well as the interesting sand pine, *P. clausa*.

For richness, fulness, and vigor of foliage, the red pine (*P. resinosa*) outranks even the much-planted more somber Austrian pine, and for interest in development nothing can compete with the longleaf pine (*P. palustris*). With its needles, which in young specimens exceed a foot in length, surrounding in dense graceful tufts the big silvery buds at the tip of the candelabra-like branches, *P. palustris* offers a most striking appearance. Unfortunately, it is not adapted for planting north of 32°.

The thin, grayish, short foliage of the frugal Bankian pine and of several other of the scrub pines, and the stouter, also grayish, foliage of the Scotch pine, make a pleasing color contrast against the somber dark background of spruces and firs, while the short stiff needles of the nut pine, *P. edulis*, and the interesting one-needle pine (*P. monophylla*) resemble the spruce foliage. Color of bark varying in species from silvery gray through red and yellow tints to almost black, and character or size of cones from the diminutive globose forms of *P. contorta* to the long pendulous cones of the sugar

pine, 2 feet in length, and the hooked, ponderous cones of *P. Torreyana* and *P. Sabiniana*, may also influence choice of material.

With wide range of distribution and hence adaptiveness as far as climate is concerned, we have the short-leaf pine (*P. echinata*), which is found from Massachusetts to Texas, and in the West the bull pine (*P. ponderosa*), which ranges from the moist Pacific Coast in Washington to the dry slopes of Arizona. In Europe, the Scotch pine comes nearest to such wide distribution. Besides the native northern species, there have been found hardy in the northeastern states the Scotch and Austrian pines, *P. Bungeana*, *P. Cembra*, *P. koraiensis*, *P. montana*, *P. Thunbergii*, while the Mexican pines and those of southern Asia will endure only the light frosts of the southern states. Yet in the parks of Washington, D. C., the following pines are to be found: *P. Strobus*, *P. Cembra*, *P. excelsa*, *P. Lambertiana*, *P. Ayacahuile*, *P. koraiensis*, *P. palustris*, *P. Tæda*, *P. ponderosa*, *P. rigida*, *P. nigra*, *P. glabra*, *P. virginiana*, *P. echinata*, *P. montana*, *P. Pinaster*, *P. edulis*, *P. pungens*, *P. sylvestris*, *P. Massoniana*; and the probability is that most of the other species could find a place there to live if not to thrive.

The list of species hardy in the Arnold Arboretum (Boston) comprises the following:

1. Thriving well.

Banksiana.	Lambertiana.	resinosa.
Bungeana.	montana.	rigida.
Cembra.	monticola.	Strobus.
densiflora.	nigra.	sylvestris.
echinata.	parviflora.	Thunbergii.
Jeffreyi.	Puce.	virginiana.
koraiensis.	pungens.	

P. excelsa and *P. ponderosa pendula* thrive well in a sheltered place, but are probably not quite hardy here.

2. Hardy, but not of promising growth.

aristata.	flexilis.
contorta var. Murrayana.	monophylla.
edulis.	

In the interior middle states the number which would stand the extremes of drought and cold would probably be reduced; a partial list found in the Missouri Botanical Garden is given below:

The best are given first. All of the later ones on the list die out sooner or later, as the city smoke is very detrimental to conifers. None does very well on that account.

Mughus (Pumilio).	} best three.	virginiana.
austriaca.		resinosa.
Strobus.		nigra.
Cembra.		sylvestris.
rigida.		ponderosa.

For seaside planting, *P. rigida* has shown itself most fit, and of foreigners in proper climate, *P. Pinaster* and *P. halepensis*, while *P. contorta* on the northwest coast and the frugal *P. radiata* on the southwest coast are the seacoast trees *par excellence*.

The pines are essentially inhabitants of the poor sandy soils and dry situations, their stout root-system enabling them to seek the scanty water-supplies where other species find it difficult. Some, like the white pine, are adapted to a variety of soil conditions, but only a few can endure a surplus of water: *P. resinosa* will follow the white cedar into the swamp and thrive there as well as with the Banksian pine on the poorest gravels; *P. rigida* is at home both in wet and dry places; the Scotch pine of the Baltic sand plains may be found in the peat-bogs, but only eking out a miserable existence, while *P. Tæda*, the old field pine, makes magnificent trees in the southern swamp, and with its slow growth under such conditions an excellent timber. *P. contorta* and *P. serotina* also are indifferent to water conditions at the root; so is the Cuban pine, but *P. palus-*

tris belies its name, for it is only very rarely found in poorly drained places and does not thrive there.

The propagation of pines does not offer any difficulties. The seed usually has a high germination percentage in most species if kept dry and cool, and it retains vitality for several years, deteriorating of course somewhat from year to year. To avoid deterioration in transoceanic shipments, packing in charcoal dust has been found very serviceable. While most of the pine seeds sprout readily, the white pine, with some others, has the bad habit of lying over for one year in part, unless treated to a hot-water bath for twenty-four hours before sowing; or perhaps by sowing in autumn immediately after coming out of the cone, which is during the first two weeks of September. The seeds should be sown in light mold early, rather thinly to permit a good root-system to develop, covering them thinly according to size of seed, not over $\frac{1}{4}$ inch, which is best done by sifting sand over the seed with a sieve. During the first year special care is necessary to regulate the water-supply and transpiration for the young seedlings; they need to be kept humid, not wet, but resent drought as much as a surfeit; and especially sudden changes from drought to wet are likely to produce "damping-off." To prevent too rapid transpiration, the familiar lath screens should be applied.

To prevent the formation of excessively long tap-roots which some species form, mechanical means may be adopted; but the best plan is to manure near the surface, so that fibrous roots will be formed. Such manure consists of one-third steamed bone-meal and two-thirds ammonia superphosphate. Root-pruning and transplanting in nursery rows when one or two years old is practised to secure a stocky root-system. In Germany one-year-old Scotch pines are planted by the million for forest purposes, but for ornamental purposes older plants are to be used; yet it is safest not to use them older than three or four years for permanent situations. In the third year usually the first branching occurs, indicating that the root-system is now well established.

In transplanting, the utmost care must be taken not to expose the roots to drying influences, a thin loam puddle answering best to keep them moist. While transplanting can be done at any time of the year, it is safest to do so in early spring, except when a droughty season is likely to follow, in which case fall planting is to be preferred.

A large number of nurserymen's varieties, dwarf and pendulous, varicolored, and the like, have been developed, especially from *P. sylvestris* and *P. Strobus*. The most interesting freaks perhaps are those bushy forms derived from *P. canariensis* and *P. Pinea* produced by layering, in which single needles instead of the usual bundles of two in one sheath are produced, imitating the primary single needles of seedlings. The manner in which nurserymen's varieties are propagated by grafts or cuttings is discussed under *Pinus*.

According to the nature of the pines, if there is choice of location possible, the well-drained situations, even dry ones, should be reserved for them. They belong, with few exceptions, to the hilltops not the bottoms, to the sands not clay soils, and will stand southern exposures better than the spruces.

Pines are frugal by nature, and can stand poverty better than surfeit,—nevertheless they respond best to medium conditions, namely, a mellow surface and well-drained deep loamy sand, not too rich in organic matter and loose enough to permit the natural development of the heavy tap-root system. Under such conditions, the peculiar rich foliage gives most satisfaction and the rank luxuriant growth which leads to poor form is checked; disease from fungi is obviated; the cottony scale (almost the only enemy of the white pine) is more readily fought, and injuries from caterpillars and beetles are more easily repaired. Lately,

two enemies of the white pine have developed which require attention. The one, a fungous disease, seems to be an importation from Germany, the white pine blister rust (*Peridermium strobi*), which attacks young trees and young foliage of the white pine tribe. It needs gooseberry and currant as intermediary host plants. The other pest is the white pine weevil, which works in the young shoots and disfigures the tree by inducing repeatedly new leaders to develop.

To prune evergreens, and especially pines, requires an artist, or else the result will be malformation: the best plan is to correct form by breaking out the center bud from such shoots as project beyond proper limits; thereby also a more compact growth is induced, which in the pines with their open habit is desirable. If it becomes necessary to prune the branches, the cut must remove also the bolster at the base of the branch; the resinous exudation will prevent decay, and the cambium soon covers the scar if the cut has been made properly. For hedge planting the pines furnish no specially desirable material, being light-needing and therefore thinning out soon in the interior; yet the white pine will stand as a hedge for a considerable time and also the dwarf *P. montana*. Perhaps some others may answer the purpose.

For the botany of the pines, see *Pinus*.

B. E. FERNOW.

PINEAPPLE. The pineapple (see *Ananas*) is indigenous to America. It produces one of the most delicious fruits now regularly on the markets. The finest qualities are developed when the fruit is permitted to ripen naturally upon the plant. For distant markets the crop has to be gathered in varying degrees of unripeness to suit the time required in transit.

The year 1850 seems to be the earliest date at which pineapple-growing was attempted in the United States. This attempt was made near St. Augustine, Florida, according to Taylor. In 1860, planting was begun on



2952. Cuttings of pineapple, ready to be planted.

the Keys, but the want of facilities for rapid transportation and the more favored Cuban and Porto Rican plantations, made the development slow. In 1897, about \$15,000 worth was imported from the Hawaiian Islands.

Good pineapple land may usually be obtained for \$25 to \$100 an acre, the higher-priced land being in favored locations at railway stations and near settlements. The cost of clearing and preparing varies from \$20 to \$80 an acre, according to the cost of labor and the character of the growth on the land.

From 8,000 to 15,000 plants are needed to the acre, varying with the variety and the notion of the planter.

The price of plants in the field varies from \$3 the 1,000 for Red Spanish to \$350 the 1,000 for the finer varieties. The cost of cultivating and fertilizing an acre for one year varies from about \$20 to \$150. It requires about eighteen months from the time of setting out to the maturing of the first crop, which yields 50 to 350 crates to the acre. Under favorable circumstances the second crop may be double that of the first. By careful attention the plantation may be continued for eight or ten years without resetting; the second or third crop frequently bears the maximum amount of fruit.

When a common variety is planted, the returns are mainly from the sale of fruit, but with fancy varieties the sale of plants constitutes the main source of returns. Four hundred dollars or more an acre has been realized frequently for a crop of the commonest varieties; in this case increase in plants cannot be considered as of much value. The value of a crop of fancy fruit is about double that of the common, and \$1,000 worth of plants may be sold without detriment to the plantation, if it is a variety that is in demand. From this must be subtracted the cost of transporting to the markets, which varies more or less with the distance the fruit is hauled. This cost varies with the quantity shipped, from \$20 to \$80 or more an acre.

The pineapple thrives in a variety of soils, but whatever its texture it must not be moist or wet. The pineapple plant will survive air-drying for months, but decays rapidly in a moist atmosphere. The greatest acreage is located upon dry sandy land, formerly overgrown with spruce-pine (*Pinus clausa*) or a mixture of spruce-pine and hardwood. Chemical analyses of the soil from pineapple fields show an exceedingly small fraction of a per cent of the essential fertilizer ingredients present. A physical analysis shows that the water-content is very low. A considerable acreage is planted on the Florida Keys. Here there is only a small amount of leaf-mold, often not more than an inch on the average, covering a coralline rock. But for the fact that pineapples actually grow and make crops on such soil it would seem entirely incredible.

With conditions of soil as described above, it is imperative to fertilize, and under the existing conditions in the pineapple belt there is no other remedy than the addition of commercial fertilizers, and nothing better. While much is still to be learned about fertilizing this crop, it is fairly well established that for pineapples on spruce-pine land, dried blood, ground bone, and nitrate of soda are good sources of nitrogen; that low-grade sulfate of potash, carbonate of potash and high-grade sulfate of potash are good sources of potash; that acid phosphate should be used in small quantities only or avoided, using pulverized bone instead. A good plan for fertilizing is to drop a small handful of cottonseed meal into the bud immediately after setting out. In October, apply about 600 pounds blood and bone and 400 pounds low-grade sulfate of potash (not kainit) to the acre, or the equivalent of these fertilizers in some of the forms mentioned above. A second application may be made the following February; at this time the amount may be increased 10 to 25 per cent, according to the growth the plants have made. A third application may be made in June or July; and if the plants have grown vigorously a still further increase in amount may be made. A fourth application may be made in October, increasing the amount if the plants have grown vigorously. The succeeding applications may be made at the time suggested above, and the increasing and decreasing of the amounts may be determined by the progress of the plants. As the average spruce-pine pineapple land is not sufficiently fertile to grow a full crop of pineapples, much more depends upon proper fertilizing than any other one operation.

This plant is propagated by means of crowns, slips, suckers, and ratoons. The crown is the leafy part

of the fruit as found in the market. Just below the fruit small plants form, which are left in the field when the fruit is gathered; these are known as slips. In the axils of the leaves buds occur; those that develop near the ground make strong plants in a few months and are known as suckers. (Fig. 2952, after Wester.) A strong plant will mature an "apple" in June and produce two to five suckers by the middle of September. Buds that



2953. The Queen pineapple.

develop from an underground part and form a root-system independent of the parent plant are known as ratoons. Crowns are not planted extensively, as they remain on the fruit when marketed. Good strong suckers are usually employed for planting out. Ratoons are left in the field to replace the plants which have borne a crop, but they are not sufficiently numerous to make a full stand; hence some of the suckers must be left also. Slips require a year longer than suckers to mature a crop. According to Webber, it requires ten to twelve years to mature a plant from seed. Plants are raised from seed only for breeding purposes.

If spruce-pine land is prepared it is cleared of all stumps, wood, roots, and any other organic material, and is plowed deep and leveled off smooth. The fields are then laid off in beds of six or eight rows wide, depending on the variety. The beds should be narrow enough to permit fertilizing and working with a scuffle-hoe without entering the beds, as breaking the leaves is very detrimental. For Red Spanish the rows are made 18 to 20 inches apart; for Queens, 20 to 22 inches; for Porto Ricos, 30 to 36 inches. They are usually placed in checks of about the same distances.

The methods employed on the Keys are quite different. The land is cleared by cutting off the trees, shrubs, and the like, which are allowed to dry and are then burned. The plants are then set out with a grubbing-hoe; they must be set out irregularly, as the rocky soil does not furnish root-hold everywhere. Such fields become exhausted in a few years and have to be abandoned.

Cultivation consists in running over the ground with a scuffle-hoe. When the plantation is set out in beds the handle of the hoe is long enough to permit cultivating to the middle without the laborer entering the bed. Only about an inch of the surface soil is agitated, usually immediately after the fertilizer has been applied. Weeds are not troublesome, excepting in fields that have been cultivated a long time. Under sheds tillage is more frequent and appears to be more necessary. On the Keys no tillage is possible, but tall-growing weeds and such ligneous plants as may spring up are cut off. In all of the work among pineapple

plants the greatest care should be exercised to avoid breaking the leaves, which are very brittle.

The fruit is picked a week before it would mature. It is packed at once into barrel (12 by 20 by 36 inches) and half-barrel (12 by 10 by 36 inches) crates, usually in the latter, the different sizes being packed in separate crates and designated as 18's, 24's, 30's, 36's, 42's, 48's, and 54's, according to the number required for a half-barrel crate. The fruit must be handled without being bruised and packed firmly to prevent its abrasion in transit. To protect the fruit each one is wrapped separately in brown paper.

Since the propagation is accomplished by means of offsets, the varieties are fairly stable and rather definitely marked. The variety most extensively grown is called Red Spanish, Spanish, or Reds. It has a medium-sized apple, and is a hardy plant. Abachi (Abakka), Blood, Queen (Fig. 2953), Sugar Loaf, Envile (Fig. 2954), and White Antigua are varieties that produce medium-sized apples of excellent quality. Black Jamaica, Black Prince, and Prince Albert produce large fruits or apples of excellent quality. Smooth Cayenne and Porto Rico produce large apples of good quality, those of the latter being of greater size. Other varieties are grown more or less extensively, and there are different names for these varieties, but the foregoing have been officially recognized by the Florida State Horticultural Society.

It has been found very advantageous to build a shelter for "pines;" in the winter a shed protects the plants from too great radiation of heat, and in the summer it reduces the intensity of the sun. The original object of the shelter was to protect the plants from frosts and freezes. Pineapple plants freeze at 32° F. This degree of cold does not kill the heart of the plant, but only the larger part of the leaves. Pines under sheds have passed through a temperature of 25° F. without serious injury. The roof of a shed is usually flat, or undulating with the surface of the land. The height varies with the desires of the individual, but is usually about 8 feet above the ground.

In Fig. 2955 the roof is slightly less than 7 feet from the ground. The stringers running crosswise in the figure are 1½" by 3" by 21'; those running lengthwise are 1½" by 1½" by 15'. The material for the roof is cypress plastering lath of usual length and width. The stringers running lengthwise are 46 inches apart. The openings between the lath are just the width of a lath. The amount of lumber needed (to the acre) is about as follows:

424 posts (352 for roof, 72 for sides) 4" x 4" x 8'.
160 pieces 1½" x 3" x 20'.
960 pieces (840 for roof, 120 for sides) 1½" x 1½" x 15'.
80,000 lath (75,000 for roof, 5,000 for sides) ¾" x 1" x 4'.

It requires about 9,000 feet of lumber for the above material exclusive of the lath. All lumber must be first-class and free from knots. This can still be reduced by about 2,500 feet by using wire in place of the 1½" by 1½" by 15' and weaving the lath in this. Under the most favorable circumstances such a shed can be erected for \$450 an acre, but this is about the cheapest and lightest form that will withstand the elements.

The following diseases and insects attack pineapples:



2954. The Envile pineapple.

(1) Heart-rot; bitter-heart: The cause of this disease is not known, but it seems to be more prevalent in a rainy season than in a dry one. It manifests itself by the portion around the heart taking on a water-soaked appearance. This condition progresses outward until the whole apple is involved. It is not necessarily accompanied by rotting, although this usually follows. The whole apple becomes bitter, even before it is entirely involved. When this disease is present in a field, the fruit should be marketed as soon as possible, that the apples may be consumed before becoming badly affected. (2) Sanding: This disorder occurs immediately after setting out, especially if a long dry spell occurs at this time. It is produced by sand being blown into and filling the bud of plants. Immediately after setting out, drop into the bud a small handful of cottonseed-meal, or the same amount of a mixture of one part ground tobacco stems and three or four parts cottonseed-meal. This soon forms a firm plug in the



2955. Pineapple shed in Florida.

bud, keeping out sand but not interfering with growth. Blood and bone, or blood, bone and tankage, may also be used. (3) Spike; longleaf: This disease manifests itself by the leaves failing to expand at the base, thus giving the plant a contracted appearance. The outer portion of the leaf spreads from the center of the plant, but usually fails to take on a broad flat healthy appearance. Experiments have proved that this disease may be produced by improper use of commercial fertilizers, although the disease has occurred where no fertilizer had been used. Abundant evidence is at hand to show that the disease is not due to an organic agent but rather to untoward condition in the soil. Change the fertilizer, avoiding acid phosphate, kainit, and cottonseed-meal in large quantities, and give protection as by a pineapple shed (spike is a rare thing under sheds). (4) Blight; wilt: This disease occurs in a sporadic manner, usually without any apparent regularity. In some varieties the first intimation of blight is by the outer end of the leaves turning red, and later by the tips wilting. This wilting progresses until the entire plant has dried up. According to Webber the direct cause is a soil-inhabiting fungus which attacks the roots. Remove the wilted plants and set in healthy ones. If the plants are of valuable varieties trim off all diseased roots and much of the stem, together with larger leaves, and reset. It is probable that the fungus will not survive until the roots again penetrate the soil. (5) Red-spider (*Stigmæus floridanus*): This species attacks the tender white portion at the base of the leaves. The effect upon the plant is greatly out of proportion to the small amount of injury to the parts attacked. In later stages the leaves rot off at the place attacked. Drop a small handful of tobacco dust into the bud of the plants.

Subsequent rains and dews leach the tobacco and carry the solution down to the red-spiders. If they are not all dead in a week or ten days, repeat the dose. (6) Scale insect (*Diaspis bromeliæ*): This scale insect becomes troublesome in dry localities and in greenhouses. The insect usually attacks the lower surface of the leaf, but each point of attack shows through as a yellow spot or blotch on the upper surface. Spray with resin wash, resin compound, or whale-oil soap. (7) Mealy-bugs (*Dactylopius citri* and other species): These insects attack the base of the leaves just at or below the ground-level; also the bud, and when fruit matures they multiply in great numbers among the slips and in the eyes of the fruit itself. The remedy is the same as for scale insects, but it is very difficult to make the application effective. When the mealy-bugs are present before the fruit-bud forms, much good can be done by applying a large handful of tobacco dust in the axils of the lvs.

See also under *Florida*, page 2230. P. H. ROLFS.

PINEAPPLE AIR-PLANT: *Tillandsia utriculata*. P. Flower: *Eucomia punctata*.

PINE, DAMMAR: *Agathis*. P., Kauri: *Agathis*. P., Moreton Bay: *Araucaria*. P., Norfolk Island: *Araucaria*. P., Prince's: *Chimaphila*. P., Screw: *Pandanus*.

PINELLIA: *Restrepia*.

PINÉLLIA (after Pinelli). *Ardeæ*. About a half-dozen hardy perennial tuberous herbs, native to China and Japan. Foliage appearing with the fls.; lvs. 3 or pedatisect; peduncle solitary; spathe marcescent; fls. monœcious in the appendiculate spadix, all fertile; perianth none; male fls. with 1 stamen; female fls. 1-sided; ovary 1-celled; ovule solitary, orthopterous.

tuberifera, Tenore. Adult lvs. 3-parted, the middle segms. $1\frac{1}{2}$ –2 times longer than wide and elliptic-oval. China.—There is a variety with narrower lf-segms. and another with lvs. cut into 5 segms.

PINGUICULA (diminutive of Latin *pinguis*, fat; referring to the succulent and greasy foliage). *Lentibulariæ*. BUTTERWORT. Small acaulescent herbs of carnivorous habits, with pretty long-spurred flowers something like a snapdragon; sometimes grown for their oddity and for the study of insectivorous habits.

Plants of moist or wet grounds, sometimes growing on damp rocks, with fibrous roots: lvs. in a basal tuft or rosette, broad and entire, soft, the upper surface usually glandular-viscid (secreting a digestive fluid) and the margins infolding when insects and other objects adhere: fls. white to purple and yellow, solitary on naked scapes which are coiled in vernation; calyx 5-lobed and somewhat 2-lipped; corolla mostly 2-lipped, ringent or more or less personate, with 5 spreading unequal lobes, the base extended into a sac or spur; stamens 2; fr. a 2-valved caps.—Species 30–40, in the northern hemisphere and also along the Andes to Patagonia. The species are little seen in cult., *P. caudata* and *P. lutea* being best known to growers. *Pinguicula* is one of the very few dicotyledonous plants with only 1 seed-leaf. The fls. of *pinguicula* are often reversed in position before and during anthesis.

This interesting genus is rarely seen under cultivation, except in botanic gardens. The most noteworthy species of the genus is the Mexican butterwort, *P. caudata*, both for its floral and leaf characters. A peculiar feature of the plant is that it produces two kinds of growth,—the resting type, in which the small succulent leaves are imbricated and form a small dense rosette about 1 inch in diameter; also the growing type, in which the obovate leaves when fully grown measure 3 to 4 inches long by 2 to 3 inches wide.—In February the small rosettes of *P. caudata* should be potted in the pans large enough to carry them throughout the

growing period, because they are not conveniently transplanted. Three plants may be placed in 6-inch pans, keeping them close to the side of the pan in triangular form. A good growing medium consists of two parts peat soil, one part fibrous loam and one part sand, with plenty of drainage. When in full growth, the top of the pan will be fully covered by the viscid leaves. Watering the plants from above should not be practised because of destroying the dew-like deposit on the surface of the leaves. The pans should be placed in saucers of water, and set in a light position in the warm-house; give plenty of sunshine and the plants will readily flower throughout the summer. In October place the plants in the cool end of the house to rest. The growth will gradually deteriorate until it assumes the rosettes of small succulent leaves to carry them through the resting period.—Young plants are propagated almost as readily as *echeverias*. The small rigid leaves should be carefully broken from the main stem; if not broken clean they will not reproduce young plants. These should be laid flat on sand in pans of convenient size; the top of the pan should be protected by glass or a bell-jar, to retain the moisture; place the pan in a saucer of water. In four to six weeks the young plants with the leaf attached will be sufficiently rooted to allow potting. One of the worst pests are woodlice. (G. H. Pring.)

A. Color of fls. yellow.

lutea, Walt. Exceptional by reason of its yellow fls. and nearly regular (not 2-lipped) corolla: variable in the size of all its parts, and in the obtuse toothing of the corolla-lobes: lvs. ovate to oblong-ovate: scapes 5–12 in. high; fls. $\frac{1}{4}$ – $1\frac{1}{2}$ in. long and broad; spur curved, about as long as the rest of the corolla; throat spotted and lined with red; palate very prominent and densely bearded. Low pine barrens, N. C. to Fla. and La. B.M. 7203. B.R. 126.

AA. Color of fls. purple to lilac.

B. Spur 2 or 4 times as long as remainder of the corolla.

caudata, Schlecht. (*P. orchidioides*, A. DC. *P. Bakeriana*, Hort.). Lvs. in dense rosettes when young, long and narrow; on older plants few and large, obovate and obtuse: scapes 5–7 in. high; fls. deep carmine, with lighter throat and reddish lines, attaining 2 in.; lobes all rounded except the middle one of the lower lip, which is retuse. Mex. B.M. 4231. G.C. II. 15:541. R.H. 1902:456. Gn. 23, p. 309. G. 29:181. G.W. 9, p. 482; 12, pp. 308–10. Var. *superba*, Hort. Fls. rich rosy carmine with white eye, about 2 in. long and nearly as broad.—According to W. Watson, England, *P. caudata* “is largely grown by orchid-breeders, who find it an excellent trap for the tiny midge-like fly which lays its eggs in orchid seedlings when they are very young. . . . It is a most charming little pot-plant, and has become a favorite in many gardens.”

Rösei, W. Wats. Very like *P. caudata* and perhaps a form of it, but the fl. deep violet-purple, almost a blue, nearly 2 in. across and remaining fresh for weeks. Prop. from the fleshy lvs. Mex. G.C. III. 49:82.

gypsicola, Brandeg. Plant 3–4 in. high: lvs. when plant is in bloom linear from a rather broad base, about 2 in. long, revolute on margins, with viscid glandular hairs on upper surface; later or winter lvs. spatulate-oblong and cotyledon-like, in a very dense rosette: fl. purple, with a very short white tube; upper lip 2-parted into linear-oblong lobes; lower lip 3-parted into similar lobes; spur more than 1 in. long, slender, purplish, 2-toothed at tip. Mex. B.M. 8602.

BB. Spur about as long as remainder of the corolla.

c. Fls. $\frac{3}{4}$ –1 in. long and broad.

grandiflora, Lam. Scapes 3–8 in. long; fls. “blue, rarely purplish violet,” according to De Candolle,

10–15 lines long, 9 lines broad (3 or 4 times longer than in *P. vulgaris*); lobes undulate; palate with 1 or 2 white spots; spur straight, a trifle shorter than the broadly funnel-shaped tube. W. Eu. G.C. III. 10:373.—According to Bentham, this is a large-fl. variety of *P. vulgaris*, with longer spur and broader lobes, which in the western part of Eu. passes into the common form.

hirtiflora, Tenore. Scapes 3–4 in. high; fls. 8 lines long and broad, lilac or rose (blue according to Tenore, and shown as purple in B.M.), with a white tube; spur straight or curved, about as long as the rest of the corolla. S. Eu. B.M. 6785. Gn. 25, p. 291. G. 11:251.—Possibly distinguished from *P. grandiflora* by the color of the tube, which is white outside and yellow in the throat. According to Burbridge there is a variety with pure white fls.

cc. Fls. $\frac{1}{2}$ in. long and broad.

vulgaris, Linn. According to Hooker, this differs from *P. hirtiflora* in the bright blue color and the retuse lobes of the corolla, as also in the less globose caps.: scapes 1–5 in. high; fls. bluish purple or violet, about 6 lines long; spur nearly straight, about 2 lines long or as long as the rest of the corolla. Wet rocks, Eu., Asia, New England, and north and westward. Gn. 57, p. 335; 69, p. 101.—Sometimes called “Labrador violet.”

P. elatior, Michx., in N. C. to Fla., is a beautiful species that should be in cult.: plant 3–5 in. across and 10–12 in. tall: lvs. viscid-glandular, in pale green rosettes: fls. whitish purple, to $\frac{3}{4}$ in. broad.

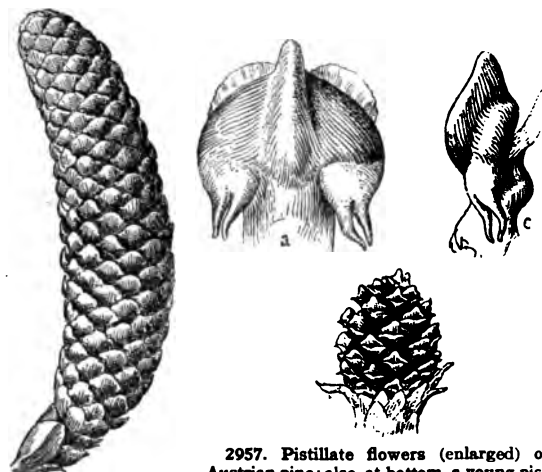
WILHELM MILLER.

PINK: *Dianthus*.

L. H. B.†

PINUS (ancient Latin name). *Pindcæx*. PINE. PINE-TREE. Ornamental trees grown for their handsome evergreen foliage and symmetrical or picturesque habit, some also for their conspicuous large cones; many species are valuable timber trees. See *Pine*.

Resinous evergreen trees with usually whorled branches, rarely shrubby: winter buds covered with

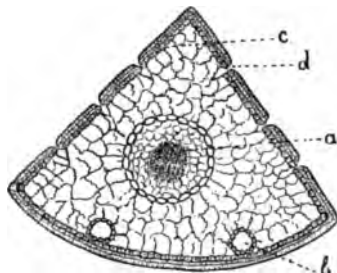


2956. Staminate cone of *Pinus rigida*. ($\times 2$)

2957. Pistillate flowers (enlarged) of Austrian pine; also, at bottom, a young pistillate cone (natural size). a, front view of two ovules; c, side view.

imbricate scales: lvs. of 2 kinds; the primary lvs. are spirally arranged and as they appear on young seedling plants and occasionally on shoots from the old wood, are green and subulate, but commonly they are reduced to small scarious bracts bearing in their axils the acicular, semi-terete or triangular secondary lvs. borne on an undeveloped branchlet in clusters from 2–5, or occasionally more, rarely reduced to 1, surrounded at the base by sheaths of 8–12 bud-scales: fls. monœcious; the

staminate ones axillary, clustered at the base of the young shoots, catkin-like, yellow, orange, or scarlet, composed of spirally arranged numerous 2-celled anthers with the connective enlarged and scale-like at the apex (Fig. 2956); pistillate lateral or subterminal, greenish or purplish, consisting of numerous spirally arranged scales each in the axil of a small bract and bearing 2 ovules inside near the base (Fig. 2957): cone subglobose to cylindric, with woody scales closely appressed before maturity and tightly inclosing the seeds, which are usually furnished with a long thin wing, but in some species are wingless or short-winged; the apex of the scales is usually more or less thickened and the exposed part, which is usually rhombic in outline and termed apophysis, is often protracted into prominent bosses or knobs; the apophysis is terminated by the umbo, usually differing in color and ending mostly in a spine or prickle. In *P. Strobus* and the allied species the apophysis is flat and thin, and bears the spineless umbo at the upper end, while in most other pines the apophysis is thickened and transversally keeled and bears the umbo in the middle. These differences belong to the most important characters in the grouping of the species: other valuable characters are furnished by the structure of the lvs., which contain either 1 or 2 fibro-vascular bundles and usually 2 or more resin-ducts, being either external (or peripheral), i.e., situated beneath the epidermis; or medial (or parenchymatous), i.e., inclosed by the tissue of the lf., or internal, i.e., close to the fibro-vascular bundles; some

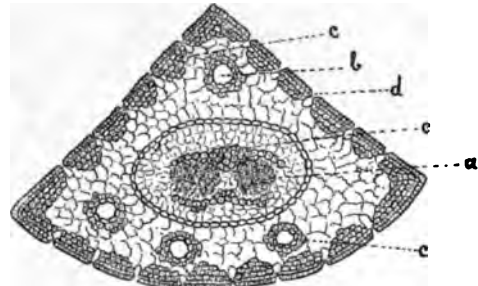


2958. *Pinus Strobus*.

Leaf with a single fibro-vascular bundle (a), usually two external resin-ducts (b); strengthening cells (c) only beneath the epidermis; stomata (d) only on the two inner sides.

species, as *P. Armandi*, *P. resinosa*, *P. sinensis*, also *P. excelsa*, *P. Lambertiana*, *P. virginiana*, and the like, have resin-ducts in 2 positions, either external and medial or internal and medial, but such combinations are not found in all the lvs. of these species. Strengthening cells, i.e., cells with thickened walls, are mostly present beneath the epidermis and often surround the resin-ducts, sometimes also along the fibro-vascular bundles. (See Figs. 2958-2961.) The number of the fibro-vascular bundles and the position of the resin-ducts can be readily seen with a common magnifying glass in thin cross-sections made with a sharp razor from the middle of the lf. and placed on a glass plate.—About 80 species are known, distributed throughout the northern hemisphere from the arctic circle to Mex. and the W. Indies, N. Afr., and the Malayan Archipelago; in the tropical and subtropical regions they are confined to the mountains. In the following enumeration the species are grouped according to Shaw's classification. To facilitate the determination of the cult. species, a key is given to determine plants without cones, but owing to the great variability in pines this key may fail, if the plant in hand represents some uncommon variation. Good illustrations are found in Sargent, Silva of N. America, vol. 11; Lambert, Description of the Genus Pinus; Lawson, Pinetum Britannicum; Forbes, Pinetum Woburnense; Antoine, Die Coniferen; Clinton-Baker, Illustrations of Conifers, vol. I; Pardé, Iconographie des Conifères (in course of publication). For the horticultural varieties, see Beissner, Nadelholzkunde, second edition (1909), and the new edition by A. H. Kent of Veitch's Manual of the Conifere. Among other important works may be mentioned E. A. Carrière's Traité

général des Conifères, second edition, 1867; Heinrich Mayr's Die Waldungen von Nordamerika, 1890; G. Engelmann's Revision of the Genus Pinus, in Transactions of the Academy of Science of St. Louis, published in 1880; Maxwell T. Masters in Journal of the



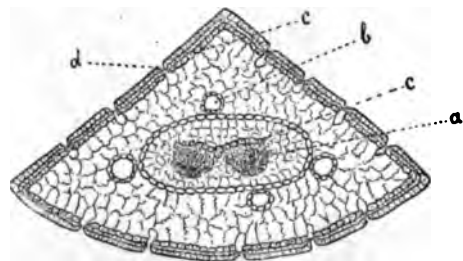
2959. *Pinus Coulteri*.

Leaf with two fibro-vascular bundles (a); several medial resin-ducts (b); strengthening cells (c) around the resin-ducts, several layers beneath the epidermis and along the inner and outer side of the fibro-vascular bundles; stomata (d) all around.

Linnean Society, vols. 22 (1886) and 27 (1889); Conifer Conference in Journal Royal Horticultural Society, vol. 14 (1892); Silva Tarouca's Unsere Freiland-Nadelhölzer (1913); G.R. Shaw's The Pines of Mexico (1909) and The Genus Pinus (1914), both well illustrated.

The pines are usually tall trees, rarely shrubby, with spreading branches forming a pyramidal or round-topped, in old age often very picturesque head, and clothed with acicular leaves in clusters of 2-5, rarely solitary. The flowers are catkin-like, appearing in spring, the staminate yellow or purple, often conspicuous by their abundance, and the pistillate greenish or purplish, developing into subglobose to cylindric, usually brown cones, which sometimes attain 18 or more inches in length, ripening mostly not before the second or rarely the third year. The pines are among the most important timber trees of the northern hemisphere, and many of them are valuable for the decoration of parks and gardens.

Young pines are with few exceptions of more or less regular, pyramidal habit; but in old age they are often very picturesque, especially *P. Strobus*, *P. radiata*, *P. rigida*, *P. Pinea*, *P. Cembra*, *P. nigra*, *P. parviflora*, and others. Of very graceful habit, with slender branches and more or less drooping foliage, are *P. excelsa*, and the tender *P. Ayacahuite*, *P. longifolia*, and *P. canariensis*. The very large cones of some species, as *P. Lambertiana*, *P. Ayacahuite*, *P. Sabiniana*, and *P. Coulteri*, are a conspicuous ornament. Most species are of vigorous growth when young, but the foreign species usually grow rather slowly and are therefore well suited for smaller gardens, especially *P. koraiensis*, *P. Peuce*, *P. Bungeana*, *P. parviflora*; the American *P. aristata* and *P. flexilis* may also be recommended for this



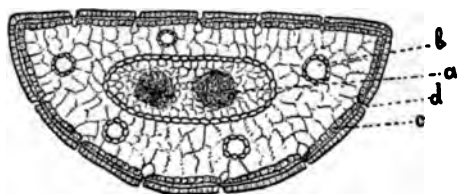
2960. *Pinus palustris*.

Leaf with two fibro-vascular bundles (a); several internal resin-ducts (b), one layer of strengthening cells (c) beneath the epidermis and on the inner side of the fibro-vascular bundles; stomata (d) all around.

purpose. For planting rocky slopes *P. Banksiana*, *P. rigida*, *P. virginiana*, and some western species are valuable; and if dwarf forms are desired *P. montana* is one of the best, thriving better than any other species in shaded positions and as undergrowth in open woods.

A great number of the species are hardy North. Among the hardiest are *P. Strobus*, *P. Cembra*, *P. parviflora*, *P. Bungeana*, *P. koraiensis*, *P. rigida*, *P. Banksiana*, *P. Thunbergii*, *P. resinosa*, *P. sylvestris* and *P. montana*. The Mexican species and those from southern Asia stand only a few degrees of frost.

The pines are not very particular as to the soil, and in their native habitats they usually occupy the less fertile situations, as dry uplands and sandy plains. Some, as *P. rigida*, *P. caribæa*, and *P. Tæda*, can be grown both in dry and in swampy ground. *P. palustris* is very unhappily named, since it almost never grows in swamps. Pines are much used for the afforestation of barren sandy plains and dry rocky mountain slopes. For seaside planting *P. rigida* and the more tender *P. radiata*, *P. Pinaster*, *P. halepensis*, and *P. canariensis*



2961. *Pinus echinata*.

Leaf with two fibro-vascular bundles (a) and several medial resin-ducts (b); only one layer of strengthening cells (c) beneath the epidermis; stomata (d) all around.

are valuable; the last three species are now much planted in California, both for timber and ornament.

Pines cannot be transplanted as successfully as large plants on account of their long tap-roots, and only younger nursery-grown trees should be used for planting. As they cannot usually be taken up with a good ball of earth, it is well to immerse the roots in a foam puddle immediately after the trees are dug up.

Pines are propagated by seeds sown in spring in prepared beds or frames, or in boxes or pans; the seeds should be covered slightly with fine soil, but the larger ones about $\frac{1}{4}$ inch, and the young seedlings shaded and watered when necessary. Varieties and rarer kinds are grafted on their types or allied species, usually by veneer-grafting on potted stock in the greenhouse in winter, or in spring outdoors by cleft-grafting in the terminal bud (M.D. 1901, p. 15). Cuttings even of the dwarf forms do not root readily; the easiest to root are young shoots with primary foliage, as they sometimes appear on older branches or on the trunk.

The pines belong to the most important timber trees in their native countries; these are, in eastern North America, *P. palustris*, *P. Strobus*, and *P. echinata*; in the western states, *P. Lambertiana*, *P. monticola*, and *P. ponderosa*; in Europe, *P. sylvestris* and *P. nigra*; in eastern Asia, *P. Thunbergii* and *P. densiflora*, and in the Himalayas, *P. excelsa*. From the resinous secretions of many species, chiefly *P. palustris*, *P. caribæa*, *P. Pinaster*, *P. halepensis*, and *P. longifolia*, turpentine, tar, and pitch are obtained. An essential oil used medicinally is distilled from the leaves and young shoots of several species. Edible seeds are produced by some species, in America by *P. edulis* and *P. cembroides*; in Europe by *P. Pinea* and *P. Cembra*; in East India by *P. Gerardiana*. Mats similar to cocoa mats are manufactured from the leaves of *P. palustris*, and pine wool for stuffing mattresses is made from leaves of European and American species.

For another account of the relative value of species of *Pinus* and their culture, see *Pine*.

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| <i>Coulteri</i> , 48. | <i>Mughus</i> , 26. | <i>tenuifolia</i> , 27. |
| <i>crispata</i> , 25. | <i>muricata</i> , 43. | <i>Thunbergii</i> , 29. |
| <i>cubensis</i> , 35. | <i>Murrayana</i> , 42. | <i>Torreyana</i> , 50. |
| <i>densata</i> , 29. | <i>nana</i> , 8. | <i>tuberculata</i> , 47. |
| <i>densiflora</i> , 22. | <i>nepalensis</i> , 7. | <i>umbraulifera</i> , 8, 22. |
| <i>divaricata</i> , 41. | <i>nigra</i> , 27. | <i>uncinata</i> , 26. |
| <i>Don-Pedrii</i> , 11. | <i>nigricans</i> , 27. | <i>variegata</i> , 7, 22, 23. |
| <i>echinata</i> , 32. | <i>nivea</i> , 8, 25. | <i>virgata</i> , 25. |
| <i>edulis</i> , 14. | <i>Oculus-draconis</i> , 22. | <i>virginiana</i> , 40. |
| <i>eldarica</i> , 36. | 28. | <i>Willsonii</i> , 29. |
| <i>Elliotii</i> , 35. | <i>oleosperma</i> , 13. | <i>yunnanensis</i> , 29. |
| <i>engadinensis</i> , 25. | <i>Pallasiana</i> , 27. | <i>zebrina</i> , 7. |
| <i>excelsa</i> , 6, 7. | <i>palustris</i> , 34. | |
| <i>fastigiata</i> , 8, 25. | <i>Parryana</i> , 12. | |

NO. I. KEY TO THE SPECIES WITH THE CONES.

I. SOFT PINES (*Haploxyloz*).

Wood soft, close-grained, light-colored, the sap-wood thin and nearly white; sheaths of the lf.-clusters deciduous; lvs. with 1 fibro-vascular bundle.

- A. Umbo of scales terminal.
- B. Segs wingless or with rudimentary wing.
- C. Margin of lvs. serrulate.
- D. Branchlets hairy: cones indehiscent.
 - E. Cones ovate: branchlets brownish tomentose. 1. *Cembra*
 - EE. Cones cylindric-conical: branchlets pubescent. 2. *koraiensis*
 - DD. Branchlets glabrous: cones dehiscent, cylindric-conical. 3. *Armandi*
 - CC. Margin of lvs. entire: cones dehiscent: lvs. stout, $1\frac{1}{4}$ –3 in. long. 4. *flexilis*
- BB. Seeds winged, with long wing, short in No. 5.
- C. Cones less than 10 in. long.
- D. Scales of cone with convex thickening.
 - E. Length of cone about 2 in., shape ovate: branchlets pubescent: lvs. $\frac{3}{4}$ – $1\frac{1}{2}$ in. long. 5. *parviflora*
 - EE. Length of cone $3\frac{1}{4}$ –10 in., shape cylindric: branchlets glabrous.
 - F. Lvs. 3–4 in. long, stiff. 6. *Peuce*
 - FF. Lvs. 6–8 in. long, drooping. 7. *excelsa*
 - DD. Scales of cone uniformly thin.
 - E. Branchlets glabrous: lvs. thin, soft. 8. *Strobus*
 - EE. Branchlets at first pubescent: lvs. stiff. 9. *monticola*

- CC. Cones 10-18 in. long: branchlets pubescent.
 D. Scales of cone rounded: lvs. stout.....10. *Lambertiana*
 DD. Scales of cone with elongated and more or less recurved apex: lvs. slender.....11. *Ayacahuite*
 AA. Umbo of scales dorsal.
 B. Seeds wingless or with very short wing: cones green at maturity.
 C. Margin of lf. entire; lvs. $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long.
 D. Number of lvs. 3 or 4.
 E. Lvs. usually 4.....12. *Parryana*
 EE. Lvs. usually 3.....13. *cembroides*
 DD. Number of lvs. 1 or 2.
 E. Lvs. usually 2, sometimes 3. 14. *edulis*
 EE. Lvs. usually 1, sometimes 2. 15. *monophylla*
 CC. Margin of lf. serrulate: lvs. 3, 2-4 in. long.....16. *Bungeana*
 BB. Seeds with long wing: cones purple at maturity.
 C. Cones with minute incurved prickles.....17. *Balfouriana*
 CC. Cones with long slender prickles..18. *aristata*

II. PITCH PINES (*Diplozyton*).

Wood usually heavy, coarse-grained, generally dark-colored, sap-wood pale, often thick: sheaths of lf.-clusters persistent (in the following species): lvs. with 2 fibro-vascular bundles, serrulate: umbo of cone-scales dorsal.

- A. Seed-wing very short or long and adnate.
 B. Wing very short, deciduous: lvs. 2, 5-8 in. long.....19. *Pinea*
 BB. Wing long, adnate: lvs. 3, 8-12 in. long.
 C. Apophysis broad-pyramidal; seed $\frac{1}{4}$ in. long.....20. *canariensis*
 CC. Apophysis elongated and more or less recurved; seed $\frac{1}{4}$ -1 in. long.....21. *longifolia*
 AA. Seed-wing articulate.
 B. Wing of seed membranous, long.
 C. Lvs. in 2's: cones deciduous, deciduous at maturity, in No. 29 persistent and lvs. sometimes in 3's.
 D. Resin-ducts external.
 E. Branchlets bloomy: lvs. 2 $\frac{1}{2}$ -5 in. long.....22. *densiflora*
 EE. Branchlets not bloomy.
 F. Lvs. 4-8 in. long.
 G. Color of branchlets yellowish brown: lvs. dark green, slender and thin.....23. *Massoniana*
 GG. Color of branchlets orange: lvs. stout, light green.....24. *resinosa*
 FF. Lvs. $\frac{3}{4}$ -3 in. long.
 G. Umbo obtuse, gray: lvs. more or less bluish green.....25. *sylvestris*
 GG. Umbo more or less prickly, surrounded by a black marking: lvs. bright green.....26. *montana*
 DD. Resin-ducts medial, or medial and external.
 E. Cones deciduous: resin-ducts medial.
 F. Winter buds brown, resinous, ovate-oblong.....27. *nigra*
 FF. Winter buds grayish white, cylindric.....28. *Thunbergii*
 EE. Cones tenaciously persistent: lvs. in 2's and 3's.....29. *sinensis*
 CC. Lvs. in 3's or in 2's and 3's.
 D. The cones deciduous.
 E. Resin-ducts medial.
 F. Young cones subterminal.
 G. Branchlets orange: cones 3-6 in. long...30. *ponderosa*
 GG. Branchlets glaucous: cones 6-15 in. long...31. *Jeffreyi*

- FF. Young cones lateral.
 G. Lvs. 3-5 in. long.....32. *echinata*
 GG. Lvs. 6-9 in. long.....33. *Taeda*
 EE. Resin-ducts internal: lvs. 8-18 in. long.
 F. Winter buds whitish: cone dull brown, 6-10 in. long.....34. *palustris*
 FF. Winter buds light brown: cone lustrous, brown, 3-6 $\frac{1}{2}$ in. long.....35. *caribaea*
 DD. The cones tenaciously persistent, often serotinous: resin-ducts medial (except in No. 36).
 E. Lvs. in 2's.
 F. Resin-ducts external: umbo obtuse.....36. *halapensis*
 FF. Resin-ducts medial.
 G. Cones symmetrical.
 H. Lvs. 5-8 in. long.....37. *Pinaster*
 HH. Lvs. 1-3 $\frac{1}{2}$ in. long.
 I. Prickles of cone stout.....38. *pungens*
 II. Prickles of cone slender.
 J. Cones remaining closed for many years...39. *clausa*
 JJ. Cones opening at maturity.....40. *virginiana*
 GG. Cones unsymmetrical.
 H. Length of lvs. less than 4 in.
 I. Cones not prickly, lateral.....41. *Banksiana*
 II. Cones prickly, sub-terminal.....42. *contorta*
 HH. Length of lvs. 4-6 in.: cones with stout and large prickles..43. *muricata*
 EE. Lvs. in 3's: cone prickly.
 F. Cones symmetrical.
 G. Length of lvs. 6-8 in.: cones remaining closed for 1 or 2 years...44. *serotina*
 GG. Length of lvs. 3-5 in.: cones opening at maturity.....45. *rigida*
 FF. Cones unsymmetrical.
 G. Prickles of cone minute: upper part of trunk rough.....46. *radiata*
 GG. Prickles of cone stout: upper part of trunk smooth.....47. *attenuata*
 BB. Wing of seed thick, short: lvs. 3 or 5, 6-15 in. long: cones large.
 C. Lvs. in 3's, 6-12 in. long.
 D. Cone conical-oblong; wings about 1 in. longer than the seed: lvs. stout.....48. *Coulteri*
 DD. Cones broadly ovate; wing about $\frac{1}{2}$ in. longer than the seed: lvs. slender, flexible...49. *Sabiniana*
 CC. Lvs. in 5's, rigid, 8-15 in. long: cone broadly ovate; seed short-winged.....50. *Torreyana*

NO. 2. KEY FOR DETERMINING PINES WITHOUT CONES. (Compare Figs. 2958-2961.)

- A. Number of lvs. 5, only occasionally 3 or 4.
 B. Sheaths deciduous: fibro-vascular bundle 1.
 C. Edges of lvs. serrulate.
 D. Length of lvs. 1 $\frac{1}{4}$ -8 in.
 E. Branchlets glabrous or nearly so.
 F. The lvs. 6-8 in. long: branchlets glaucous... 7. *excelsa*
 FF. The lvs. 3-5 in. long: branchlets not glaucous.
 G. Tree a rather dense pyramid with ascending branches..... 6. *Peuce*

- GG. Tree an open pyramid.
 H. Lvs. bluish green. 8. *Strobus*
 HH. Lvs. bright green: habit loose, with wide-spreading branches. 3. *Armandi*
 EE. Branchlets densely brownish tomentose. 1. *Cembra*
 EEE. Branchlets pubescent or puberulous.
 F. Needles slender, somewhat pendulous, 4-6 in. long. 11. *Ayacahuite*
 FF. Needles stiff, 1½-4 in. long.
 G. Back of lvs. with fine white lines. 10. *Lambertiana*
 GG. Back of lvs. usually not lined.
 H. Color of lvs. bluish or dark green. 9. *monticola*
 HH. Color of lvs. bright green. 2. *koraiensis*
 DD. Length of lvs. ¾-1½ in.: lvs. usually twisted, forming brush-like tufts at the end of the branchlets. 5. *parviflora*
 CC. Edges of lvs. entire.
 D. Lvs. 1½-3 in. long. 4. *flexilis*
 DD. Lvs. 1-1½ in. long.
 E. Branchlets dark orange-brown: lvs. rigid. 17. *Balfouriana*
 EE. Branchlets orange: lvs. usually slender. 18. *aristata*
 BB. Sheaths persistent: fibro-vascular bundles 2: lvs. 8-12 in. long, rigid. 50. *Torreyana*
 AA. Number of lvs. 3, or 4 or 1, only occasionally 2 or 6.
 B. Usually solitary, sometimes in 2's. 15. *monophylla*
 BB. Usually 4, sometimes 3 or 5. 12. *Parryana*
 BBB. Usually 3, occasionally 2.
 C. Fibro-vascular bundle 1: sheaths deciduous.
 D. Margin of lvs. entire: lvs. ¾-2 in. long.
 E. Lvs. usually 3, 1-2 in. long. 13. *cembroides*
 EE. Lvs. usually 2, ¾-1½ in. long. 14. *edulis*
 DD. Margin of lvs. serrulate: lvs. 2-4 in. long. 16. *Bungeana*
 CC. Fibro-vascular bundles 2: sheaths persistent.
 D. Branchlets glaucous: lvs. bluish or grayish green (see also No. 33.)
 E. Habit of lvs. slender, drooping. 49. *Sabiniana*
 EE. Habit of lvs. straight, stiff.
 F. Buds very resinous: lvs. 6-12 in. long, dark bluish green. 48. *Coulteri*
 FF. Buds not or little resinous: lvs. 6-8 in. long, pale bluish green. 31. *Jeffreyi*
 DD. Branchlets not glaucous: lvs. dark yellow or bright green.
 E. Habit of lvs. slender, drooping.
 F. Resin-ducts internal. 34. *palustris*
 FF. Resin-ducts external.
 G. Branchlets yellowish: buds brown. 20. *canariensis*
 GG. Branchlets light yellow-brown: buds bright chestnut-brown. 21. *longifolia*
 EE. Habit of lvs. stiff.
 F. Length of lvs. 6-12 in.
 G. Resin-ducts internal: buds cylindric, with spreading scales: lvs. dark green, in 2's and 3's, 8-12 in. long. 35. *caribaea*
 GG. Resin-ducts medial.
 H. Buds oblong-ovate, slightly or not resinous: lvs. 6-9 in. long.

- I. Lvs. light bluish green. 33. *Tseda*
 II. Lvs. dark yellow-green. 44. *serotina*
 HH. Buds ovate, acuminate, resinous: lvs. 5-11 in. long, dark yellowish green. 30. *ponderosa*
 FF. Length of lvs. 3-7 in. (see also No. 29).
 G. Character of lvs. slender.
 H. Foliage pale yellowish or bluish green: buds oblong-ovate, dark brown. 47. *attenuata*
 HH. Foliage bright green: buds ovate, bright chestnut-brown. 46. *radiata*
 GG. Character of lvs. stout.
 H. Form of buds thick, ovate, acute or acuminate. 30. *ponderosa* (var. *scopulorum*)
 HH. Form of buds oblong-ovate. 45. *rigida*
 AAA. Number of lvs. 2 (see also No. 14).
 B. Branchlets glaucous.
 C. Buds very resinous. 40. *virginiana*
 CC. Buds not or little resinous.
 D. Hue of lvs. dark bluish green. 32. *echinata*
 DD. Hue of lvs. bright green. 22. *densiflora*
 BB. Branchlets not glaucous.
 C. Length of lvs. 1-3½ in.
 D. Branchlets brown or orange: resin-ducts medial.
 E. Character of lvs. slender: branchlets brown. 39. *clausa*
 EE. Character of lvs. stout, twisted: branchlets orange or orange-brown.
 F. Lvs. 1-3½ in. long.
 G. Resin-ducts 1 or 2. 42. *contorta*
 GG. Resin-ducts 2-5. 38. *pungens*
 FF. Lvs. ½-1 in. long. 41. *Banksiana*
 DD. Branchlets dull greenish yellow or greenish brown: resin-ducts external.
 E. Character of lvs. slender: buds not resinous. 36. *halepensis*
 EE. Character of lvs. stout: buds coated with resin.
 F. Generally a tree. 25. *sylvestris*
 FF. Generally a shrub. 26. *montana*
 CC. Length of lvs. 3-9 in.
 D. Color of buds whitish or grayish white. 28. *Thunbergii*
 DD. Color of buds brown (see also No. 36).
 E. Scales of the oblong buds with reflexed tips, chestnut-brown.
 F. Position of resin-ducts external.
 G. Habit of lvs. very slender and thin. 23. *Massoniana*
 GG. Habit of lvs. stiff and rigid. 19. *Pinea*
 FF. Position of resin-ducts medial or internal.
 G. Buds not resinous: lvs. lustrous green, 6-9 in. long. 37. *Pinaster*
 GG. Buds resinous: lvs. dark green, 4-6 in. long. 43. *muricata*
 EE. Scales not reflexed.
 F. Resin-ducts external: lvs. lustrous: buds ovate, acuminate, resinous. 24. *resinosa*
 FF. Resin-ducts medial: lvs. dull: buds ovate, acuminate, resinous. 27. *nigra*
 FFF. Resin-ducts medial and external: buds oblong-ovate, not resinous: lvs. sometimes 3. 29. *sinensis*

Section I. CEMBRA.

Group 1. CEMBRAE.

1. *Cembra*, Linn. SWISS STONE PINE. Tree, to 70 or sometimes 120 ft., with spreading usually short branches forming a narrow, dense pyramid, in old age often with very picturesque broad, open, round-topped head: branchlets coated with dense yellowish brown tomentum: winter buds globose-ovate, long-acuminate: lvs. straight, dark green on back, bluish white inside, 2-3½ in. long: cones short-peduncled, ovate, obtuse, light brown, 2½-3½ in. long; scales broadly ovate, rounded at apex, apophysis much broader than high; seed ½ in. long. Cent. European Alps. H.W. 1:8, pp. 174-7. G.W. 1, p. 352; 7, p. 19. G.C. II. 17:80, 81; III. 24:459. Gn. 19, p. 369; 28, pp. 175, 182; 59, p. 59; 65, p. 431. Gt. 45, p. 205; 58, p. 443.—Handsome hardy pine of slow growth and symmetrical habit when young. The large seeds are eaten. Var. *columnaris*, Beissn., is a form of narrow, columnar habit. G.W. 2, p. 209. Var. *compacta*, Beissn., is compact and conical in habit. Var. *sibirica*, Loud. (*P. sibirica*, Mayr), has shorter lvs. and longer cones, and is of narrower habit and more vigorous growth. N. Russia and Siberia. Var. *pumila*, Pall. See *P. pumila* in suppl. list.

2. *koraiensis*, Sieb. & Zucc. (*P. mandshurica*, Rupr.). Pyramidal tree, to 100 ft.: branchlets with yellowish brown pubescence: winter buds oblong-ovate, acuminate, dark chestnut-brown: lvs. straight, dark green and glossy on the back, bluish white on the inner sides, 2½-4 in. long: cones almost sessile, conic-oblong, yellowish brown, 4-6 in. long; scales rhombic-obovate, with recurved obtuse apex; seed over ½ in. long, brown, sharply edged. Japan, Korea. S.Z. 2:116. Gng. 6:1. F.E. 18:333; 25:35. S.I.F. 1:2.—In cult. of slow growth, forming a rather dense, broad pyramid, with handsome foliage. One of the best hardy pines for smaller gardens.

Group 2. FLEXILES.

3. *Armándi*, Franch. (*P. scipioniformis*, Mast. *P. Mastersiana*, Hayata). Tree, to 60 ft., with wide-spreading horizontal branches: branchlets glabrous: winter

2962. *Pinus flexilis* (×¼). No. 4.

buds cylindric, chestnut-brown: lvs. slender and thin, 3-6 in. long, serrulate, bright green: cones peduncled, oblong-conical, 4-6 or sometimes 8 in. long, yellowish brown; scales obovate, appressed, much thickened in the middle, with large broadly rhombic apophysis and small obtuse thickened umbo often slightly recurved; seeds pale reddish brown, ovoid, compressed, ½ in. long,

2963. *Pinus Strobus* (×¼). No. 8.

with a sharp edge all around. Cent. and W. China. B.M. 8347. G.C. III. 33:34 (as *P. koraiensis*), 66. R.H. 1910, p. 425.—A handsome pine which has proved hardy at the Arnold Arboretum.

4. *flexilis*, James. LIMBER PINE. Fig. 2962. Tree, to 50, occasionally to 80 ft., with stout horizontal branches forming a narrow open pyramid, in old age with low, broad, round-topped head: winter buds broadly ovate, slender-pointed: lvs. rigid, acute, dark green, 1½-3 in. long: cones short-stalked, ovate to cylindric-ovate, light brown, 3-6, rarely 10 in. long; scales rounded at the apex, tipped with an obtuse, dark umbo, the lower ones elongated and reflexed; seeds dark brown, mottled with black, ⅓-½ in. long, with narrow wing. Alberta to Calif. and New Mex. S.S. 11:546, 547. G.F. 10:165. B.M. 8467. M.D. 1904:49. F.E. 29:47.—Hardy pine of slow growth; seems to be best adapted for ornamental planting on rocky slopes. Var. *reflexa*, Engelm. (*P. reflexa*, Engelm. *P. strobiformis*, Sudw., not Engelm.). Tree, to 100 ft.: lvs. slender, to 4 in. long, entire or remotely serrulate: cones 5-9 in. long, on longer stalks, with often thin reflexed scales. Ariz. S.S. 11:544, 545. Var. *albo-variegata*, Schwerin. Has many of lvs. white.

Group 3. STROBI.

5. *parviflora*, Sieb. & Zucc. Tree, to 80 ft., of dense, pyramidal habit, with slender, horizontal branches: branchlets light greenish brown, puberulous: lvs. crowded, rather stiff, usually twisted, forming brush-like tufts at the end of the branchlets, bluish green, ¾-1½ in. long: cones ovate or oblong-ovate, almost sessile, reddish brown, 2-3 in. long; seeds dark brown, hardly ½ in. long, with short wing. Japan. S.Z. 2:115. S.I.F. 2:2. A.G. 14:212.—Hardy and very ornamental pine, bearing numerous decorative cones when older. Cult. plants are often grafted and assume a more irregular habit. In Japan it is often cult. in pots and dwarfed. Var. *glauca*, Beissn. With bluish green lvs. The wild form with somewhat longer lvs., longer cones and seeds with longer wings has been described as *P. pentaphylla*, Mayr.

6. *Peuce*, Griseb. (*P. excelsa* var. *Peuce*, Beissn.). Attains 50 ft., with ascending short branches forming a narrow dense pyramid: branchlets greenish, glabrous, not glaucous: winter buds ovate: lvs. straight, bluish green, 3-4 in. long: cones short-stalked, cylindric, 3½-6 in. long, with obovate scales; seed 4 lines long. S.E. Eu. Gn. 76, p. 613.—An ornamental hardy pine of

dense, regular habit and slow growth; forms a narrower and denser pyramid than the white pine (*P. Strobus*).

7. *excelsa*, Wall. (*P. nepalensis*, Chambr.). Attains 150 ft., with spreading and slightly ascending branches forming a broad open pyramid: branchlets greenish, glabrous, glaucous: winter buds cylindric-obovate, acute: lvs. slender, flaccid, drooping, grayish or bluish green, 6-8 in. long: cones cylindric on 1-2-in.-long stalks, 6-10 in. long; seeds brown, 4 lines long. Himalayas. Gn. 31, p. 195. A.G. 19:149. F.E. 13:664 (pl. 8); 33:113. Gn.M. 6:290. M.D.G. 1903:185.—Handsomeness of tree, of somewhat loose habit, with graceful pendulous foliage, hardy as far north as Mass. in sheltered positions. Var. *zebrina*, Bailly (var. *variegata*, Hort.), has the lvs. with a whitish zone near the tip. F.E. 31:191. R.H. 1889, p. 392.



2964. *Pinus Strobus*. (×½)

8. *Strobus*, Linn. (*Strobus Strobus*, Small). WHITE PINE. Figs. 2958, 2963, 2964. Attains 100, occasionally 150 ft., with horizontal branches in regular whorls forming a symmetrical open pyramid; in old age the head is usually broad and open and often very picturesque: branchlets greenish or light greenish brown, glabrous or slightly puberulous: winter buds ovate, acuminate: lvs. soft, bluish green, 2-4 in. long (or 3½-5): cones on stalks ½-1 in. long, cylindric, slender, often curved, 2-4 in. long, with oblong-obovate scales; seed red-brown, mottled with black, 3 lines long. Newfoundland to Man., south to Ga., Ill. and Iowa. S.S. 11:538, 539. A.G. 12:645; 13:1. Gn. 30, p. 404. F.E. 15:340. C.L.A. 11:310. H. W. 1:9, pp. 183-5.—Very valuable ornamental hardy pine of rapid growth, symmetrical when young, picturesque in old age: no tree is better adapted to break up the monotonous sky-line of plantations in northern parks. There are a number of gardens forms occasionally cult. Var. *alba*, Loud. (var. *nivea*, Carr.). Low form of irregular habit, with almost silvery white foliage. Var. *astreata*, Carr. With yellow foliage. Var. *glauca*, Beissn. With light bluish green foliage. Var. *brevifolia*, Loud. (var. *nana*, Knight. Var. *pygmaea*, Hort.). Dwarf, compact, round bush, with short lvs. F.E. 20:788 (pl. 112); 29:569. Gt. 52, p. 435. Gn. M. 2:23. Var. *fastigiata*, Beissn. (var. *pyramidalis*, Hort.). With ascending branches, of narrow pyramidal or columnar habit. Var. *prostrata*, Arb. Kew. Dwarf, procumbent form, diffuse and trailing on the ground. Var. *umbraculifera*, Knight. Dwarf, flat-topped bush, with short lvs. R.H. 1869, p. 38. There are also forms with variegated foliage.



9. *monticola*, Don. MOUNTAIN WHITE PINE. Tree, to 100 or occasionally 150 ft., with slender, spreading, somewhat pendulous branches forming a narrow open pyramid: branchlets puberulous, yellowish or reddish brown: winter buds ovate, acute: lvs. stiff, bluish green and glaucous, 1½-4 in. long, with few inconspicuous or no lines on the back: cones short-peduncled, cylindric, slender, slightly curved, 5-11 in. long, yellowish brown; scales pointed by the slightly thickened umbo; seed red-brown, mottled with black, ½ in. long. Brit. Col. to Idaho and Calif. S.S. 11:540, 541. G.F. 5:5, 7. R.H. 1869, p. 126 (as *P. Groezelieri*). F.E. 31:293.—Similar to *P. Strobus*, but forming a somewhat narrower, more slender pyramid; hardy as far north as Mass.



10. *Lambertiana*, Douglas. SUGAR PINE. Fig. 2965. Tree, to 200 or 220 ft., with spreading somewhat pendulous branches forming a narrow open pyramid; old trees usually with flat-topped wide-spreading open head: branchlets brown, pubescent: winter buds oblong-obovate, apiculate: lvs. stout, sharply pointed, dark bluish green, 3-4 in. long, with conspicuous white lines on the back: cones on peduncles 2-3½ in. long, cylindric, often slightly curved, light brown, lustrous, 10-20 in. long; seed about ½ in. long, dark brown or nearly black. Ore. to Mex. S.S. 11:542, 543. Gn. 31, pp. 152, 153. G.C. II. 23:11; III. 1:769. F.S.R. 1, p. 129. M.D.G. 1905:126. G.W. 8, p. 617.—One of the tallest trees of the Pacific Coast; in the eastern states it is hardy as far north as Mass., but grows slowly; has handsome dark foliage.

11. *Ayacahuite*, Ehrenb. (*P. Bonaparteae*, Roehl. *P. Don-Pedrii*, Roehl. *P. Loudoniana*, Gord.). Tree, to 100 ft., with spreading, slender branches: branchlets yellowish brown, finely pubescent: lvs. slender and somewhat pendulous, bluish green, 4-6 in. long: cones short-stalked, cylindric-conical, gradually narrowed toward the apex, often slightly curved, brownish yellow, 9-15 in. long; seeds about ½ in. long, gray-brown, mottled dark brown. N. Mex. G.C. II. 18:493; III. 20:751, 753. Gn. 25, pp. 192, 193. C.L.A. 7:364.—Handsomeness of tree, somewhat resembling the white pine, but foliage more slender, especially ornamental with its large cones. Not hardy N.

Section II. PARACEMBRA.

Group 4. CEMBROIDES.

12. *Parryana*, Engelm., not Gord. (*P. quadrifolia*, Sudw.). NUT PINE. PINNON. Tree, to 40 ft., with stout, spreading branches, forming a regular pyramid, but in old age usually round-topped and irregular: branchlets puberulous, light grayish brown: lvs. 3-5, usually 4, rigid, incurved, pale glaucous green, 1½-1¾ in. long: cone subglobose, 1½-2 in. broad, chestnut-brown, lustrous; apophysis thick, pyramidal, conspicuously keeled; umbo with minute recurved prickles; seed about ½ in. long. Calif. S.S. 11:549. M.D.G. 1903:97.—Not hardy N.



2965. Cones of pines. Beginning at the top: *P. Coulteri*, *P. Lambertiana*, *P. radiata*. (×½)

13. *cembroides*, Zucc. (*P. osteosperma*, Engelm.). Small tree, usually not over 20 ft., with stout spreading branches forming a round-topped head: branchlets dark orange, pubescent at first: lvs. usually 3, sometimes 2, slender, dark green, with stomata on all 3 faces, much incurved, 1-2 in. long: cone subglobose, 1-2 in. broad; apophysis pyramidal, strongly keeled, lustrous brown, with broad obtuse umbo; seeds oblong-obovate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, dark brown, with very narrow wing. Ariz. to Low. Calif. and N. Mex. S.S. 11:550. G.F. 4:353. F.S. 4, p. 325b.—A slow-growing densely branched pine; tender. By some authors the preceding and the two following species are referred to this species as simple variations in the number of lvs.

14. *edulis*, Engelm. (*Caryopitys edulis*, Small). NUT PINE. Fig. 2966. Small tree, 10-20 or occasionally to 40 ft., with horizontal branches, bushy when young, with low, round-topped head in old age: branchlets light yellowish brown, puberulous at first: lvs. 2-3, rigid, dark green, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: cones almost sessile, broadly ovate, greenish yellow, lustrous, about 1 $\frac{1}{2}$ in. long; apophysis pyramidal, strongly keeled; umbo with minute recurved tip; seed $\frac{1}{2}$ in. long, with narrow wing remaining attached to the scale. Colo. to N. Mex. and Texas. S.S. 11:552. F.E. 29:205.—Hardy as far north as Mass., forming a slow-growing and compact bush. The seeds are an important article of food among the Indians. Var. *albo-variegata*, Hort., has white lvs. mixed with the green ones.

15. *monophylla*, Torr. & Frem. (*P. Fremontiana*, Endl.). Tree, 15-20, occasionally to 50 ft., similar to the preceding: branchlets light orange, glabrous: lvs. usually solitary, sometimes 2, terete, rigid, spinescent, glaucous green, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: cones broadly ovate, light brown, 1 $\frac{1}{2}$ -2 in. long; apophysis depressed-pyramidal, ridged, the flattened umbo with a minute incurved tip; seed $\frac{1}{2}$ in. long. Calif. to Colo. and Ariz. S.S. 11:551. G.C. II. 20:44; 26:137.—Of slow growth, hardy as far north as Mass. The solitary lf. has been believed to consist of 2 connate ones, but this is certainly not the case, as the solitary fibro-vascular bundle plainly shows.



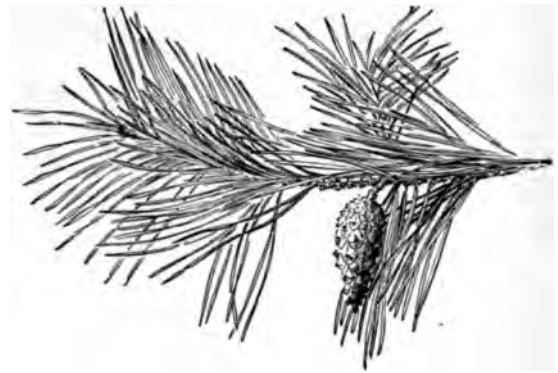
Group 5. GERARDIANÆ.

16. *Bungeana*, Zucc. LACE-BARK PINE. WHITE-BARK PINE. Tree, to 80 or 100 ft., with long and slender branches: bark flaky, light gray: young branches grayish green, glabrous: lvs. rigid, acute, light green, 2-4 in. long: cones almost sessile, conic-ovate, light yellowish brown, 2-3 in. long; apophysis much broader than high, ridged, with a triangular pointed and recurved umbo; seed dark brown, with narrow wing, $\frac{1}{3}$ - $\frac{1}{2}$ in. long. N. W. China. B.M. 8240. G.C. II.

18:9.—Hardy slow-growing tree of bushy habit in cult. and with rather sparse light green foliage.

Group 6. BALFOURIANÆ.

17. *Balfouriana*, Jeffrey. FOXTAIL PINE. Tree, to 40, occasionally 90 ft., narrow-pyramidal when young, irregular and open in old age: branchlets dark brown,



2967. Scotch pine.—*Pinus sylvestris* ($\times \frac{1}{4}$). No. 25.

puberulous at first: lvs. crowded, incurved and pressed against the branches, rigid, acute, dark green on the back, with conspicuous white lines inside, 1-1 $\frac{1}{2}$ in. long, remaining for 10-12 years on the branches: cones pendulous, subcylindric, dark purplish brown, 3 $\frac{1}{4}$ -5 in. long; apophysis flattened, the concave oblong umbo with minute incurved prickle; seed $\frac{1}{2}$ in. long. Calif. S.S. 11:553.—Not hardy N.

18. *aristata*, Engelm. (*P. Balfouriana* var. *aristata*, Engelm.). HICKORY PINE. FOXTAIL PINE. Bushy tree, occasionally to 50 ft., sometimes a semi-prostrate shrub: branchlets light orange and almost glabrous: lvs. stout or slender, dark green, 1-1 $\frac{1}{2}$ in. long, with white lines inside: cones cylindric-ovate, 3-3 $\frac{1}{2}$ in. long; apophysis elevated; umbo with a slender incurved spine to $\frac{1}{4}$ in. long; seed $\frac{1}{4}$ in. long. Calif. to Utah and Ariz. S.S. 11:554. G.C. III. 20:719. M.D. 1904, p. 49 (pl. 5).—Hardy as far north as Mass.; in cult. usually a handsome low, bushy shrub of distinct habit: lvs. often sprinkled with resinous dots.

Section III. PARAPINASTER.

Group 7. PINEÆ.

19. *Pinea*, Linn. STONE PINE. Tree, to 80 ft., with long, horizontally spreading branches forming in older trees a broad, flat-topped head: branchlets pale brown: buds with revolute scales, oblong-ovate, not resinous: lvs. rigid, acute, bright green, 5-8 in. long: cones broadly ovate, chestnut-brown, 4-5 $\frac{1}{2}$ in. long; apophysis depressed-pyramidal, radiately ridged; umbo flat, obtuse; seed reddish brown, $\frac{3}{4}$ in. long, edible. S. Eu. G.C. II. 20:45; III. 4:604, 605. Gn. 27, pp. 245-7; 50, p. 460; 76, p. 648. H.W. 1, pp. 170, 171. F.S.R. 2, p. 274. J.H. III. 68:447.—Tree of picturesque habit, with a trunk usually destitute of branches for a considerable height and with a wide-spreading parasol-like head. Not hardy N.; in warmer regions often cult. for its edible seeds.

Group 8. LONGIFOLIÆ.

20. *canariensis*, C. Smith. Tree, to 80 ft., with slender branches forming a broad, round-topped head: branchlets yellowish: lvs. slender, spreading and pendulous, light green and lustrous, 9-12 in. long, with medial resin-ducts: cones cylindric-ovate, 4-8 in. long; apophysis low-pyramidal, irregularly 4-sided, light brown and

glossy, with obtuse umbo; seed $\frac{1}{2}$ in. long. Canary Is. G.C. III. 3:721.—Handsome pine cult. in Calif., where it does very well and grows faster than the native *P. radiata*, even in very rocky and dry locations; in colder regions grown sometimes in the greenhouse.

21. *longifolia*, Roxbg. (*P. Roxburghii*, Sarg.). Tree, to 100 ft. or more, with round-topped symmetrical



2968. Mugho pine.—*Pinus montana* var. *Mugho*. No. 26.

head: branchlets light yellow-brown: winter buds oblong, light chestnut-brown, not resinous: lvs. slender, pendulous, light green, 8-12 in. long, with external resin-ducts: cones short-stalked, conic-ovate, 4-7 in. long; apophysis elongated-pyramidal, compressed, more or less recurved; umbo obtuse; seed $\frac{3}{4}$ -1 in. long. Himalayas.—Important forest tree in its native country. Not hardy N., but cult. in Calif. Very decorative as a young plant, with its long drooping light green foliage.

Section IV. PINASTER.

Group 9. LARICIONES.

22. *densiflora*, Sieb. & Zucc. JAPANESE RED PINE. Tree, to 100 ft., with spreading branches forming an irregular, rather broad head: branchlets orange-yellow, bloomy: buds oblong-ovate, chestnut-brown: lvs. slender, acute, bright bluish green, $2\frac{1}{2}$ -5 in. long: cones short-stalked, conic-ovate to oblong, grayish brown, somewhat oblique at the base, about 2 in. long; apophysis flattened and slightly ridged, those near the base sometimes elongated; umbo small, with a short prickle or obtuse; seed grayish yellow, $\frac{1}{2}$ in. long. Japan. S.Z. 2:112. S.I.F. 1:1. Gn.M. 2:22.—Ornamental hardy tree, rapidly growing when young, often very picturesque when older. Many garden forms are cult. in Japan, several of them with variegated lvs. The best are perhaps var. *umbraculifera*, Mayr, a low form with horizontally spreading branches forming a flat head; var. *pendula*, Mayr, with pendulous branches; var. *aurea*, Mayr, with yellow foliage; var. *albo-terminata*, Mayr, with the tips of the lvs. yellowish white, and var. *Oculus-draconis*, Mayr, like var. *variegata*, Mayr, similar to the varieties, of the same name under *P. Thunbergii*. (No. 28.)

23. *Massoniiana*, Lamb. Tree, to 80 ft., with slender, spreading branches: branchlets yellowish brown: lvs. very slender and thin, light green, 5-8 in. long: cones oblong-ovate or ovate, dull brown, 2-3 in. long; apophysis flattened, slightly keeled, with a small, flat, unarmed umbo; seed $\frac{1}{2}$ in. long. China.—Not hardy N. and rarely cult. Often confounded with *P. sinensis* and *P. densiflora*.

24. *resinosa*, Ait. RED PINE. NORWAY PINE. Tree, to 70, occasionally to 150 ft., with stout spreading and sometimes pendulous branches forming a broad pyramidal head when young and an open round-topped one in old age: branchlets orange-color: buds ovate, acuminate, light brown, resinous: lvs. slender and flexible, acute, dark green and lustrous, 4-6 in. long: cones subsessile, conic-ovate, light brown, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; apophysis flattened, conspicuously keeled, obtuse, with small dark unarmed umbo; seeds dark brown, $\frac{1}{2}$ in.

long. Newfoundland to Man., south to Pa. and Minn. S.S. 11:550, 551. A.G. 12:645. C.L.A. 11:310.—One of the most ornamental pines for northern parks, quite hardy and of vigorous growth. Lumber tree.

25. *sylvestris*, Linn. SCOTCH or SCOTS PINE. Fig. 2967. Tree, to 70, or occasionally 120 ft., with spreading, often somewhat pendulous branches, pyramidal when young, with broad and round-topped often picturesque head in old age: branchlets dull grayish yellow: winter-buds oblong ovate, brown, resinous: lvs. rigid, acute, twisted, bluish green, $1\frac{1}{2}$ -3 in. long: cones short-stalked, conic-oblong, grayish or reddish brown, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; apophysis little thickened, slightly keeled, only those near the base elongated; umbo small, obtuse; seed dark gray, $\frac{1}{2}$ in. long. Eu. to W. and N. Asia. Gn. 36, p. 167; 38, p. 455; 49, p. 296. H.W. 1:4, pp. 121-6. F.E. 29:157. G.C. III. 34:298. F.S.R. 1, p. 16.—One of the most important timber trees of Eu. It is quite hardy, but has little to recommend it as an ornamental tree. Several geographical and garden forms have been distinguished. Var. *argentea*, Stev. Foliage light bluish green, with silvery hue. Var. *aurea*, Beissn., with the young lvs. golden yellow. F.E. 13:972 (pl. 14). Var. *nivea*, Schwerin. Lvs. a dirty greenish white. Var. *Beissneriana*, Schwerin. Lvs. green at first, changing to golden yellow in summer. Var. *columnaris compacta*, Baily. Slow-growing, dense, columnar form. R.H. 1889, p. 393. Var. *fastigiata*, Carr. (var. *pyramidalis*, Hort.). Of pyramidal habit. Var. *virgata*, Casp. Sparingly branched form with long flagellate branches. H.W. 1, p. 126. Var. *crispata*, Schwerin. Lvs. curved in different directions, having a crisp appearance. Var. *pendula*, Beissn. With pendulous branches. Var. *pumila*, Beissn. Dwarf globose bush. Besides these varieties a number of geographical races have been distinguished which differ chiefly in habit, growth, and hardiness and are more of silvicultural than of horticultural interest. The best known are var. *rigensis*,



2969. Austrian pine.—*Pinus nigra* var. *austriaca* ($\times \frac{1}{2}$). No. 27.

Loud., with a straight tall st.; var. *lappónica*, Fries (*P. lappónica*, Mayr). A pyramidal form of slow growth: lvs. broader and shorter, remaining green on the branches for 4-7 years: cones more yellowish. N. Eu. Var. *engadinensis*, Heer. A slow-growing pyramidal form with thick and rigid lvs. 1-1 $\frac{1}{2}$ in. long and grayish green. Tyrol.

26. *montana*, Mill. SWISS MOUNTAIN PINE. Very variable in habit, usually low, often prostrate shrub, sometimes pyramidal tree to 40 ft., similar to the preceding: branchlets usually of darker, brownish color: lvs. bright green, acutish, stout, crowded, $\frac{3}{4}$ –2 in. long: cones ovate or conic-ovate, $\frac{3}{4}$ –2 $\frac{1}{4}$ in. long; apophysis often pyramidal; umbo light gray, surrounded by a blackish ring. An anatomical character in the lvs. to distinguish this species from the preceding is found in the cells of the epidermis which are of nearly equal diam. with a dot-like central space in *P. sylvestris*, but in this species are much higher than broad with a dash-like central space.



2970. *Pinus ponderosa*. ($\times \frac{1}{2}$)

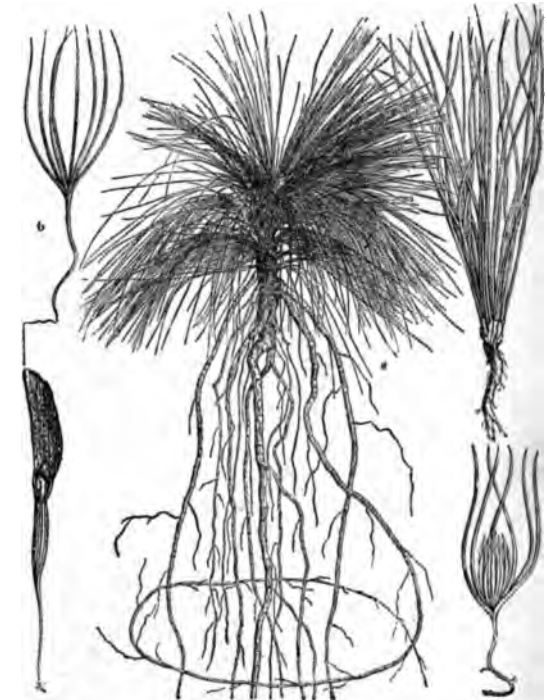
Mts. of Cent. Eu. Gn. 30, p. 225. Mn. 5, p. 49. H.W. 1:5, pp. 140–3. M.D. 1912, pp. 141–8. G.W. 1, p. 351.—Handsome hardy low shrub with ascending branches densely clothed with bright green foliage; ornamental as single specimens or for covering rocky slopes and as undergrowth in open woods. A very variable species which has been divided according to the cones into the following 3 varieties or subspecies: Var. *uncinata*, Willk. (including vars. *rostrata* and *rotundata*, Ant., var. *arborescens*, Tabeuf). Cone very oblique, usually deflexed; apophysis pyramidal, with often reflexed umbo. Often arborescent. Var. *pumilio*, Willk. (*P. pumilio*, Haenke. *P. carpatica*, Hort., var. *frutescens erecta*, Tabeuf). Cone regular, subglobose to ovate, before maturity glaucous and usually violet-purple, ripe yellowish or dark brown. Usually shrubby and upright. Var. *Mughus*, Willk. (*P. Mughus*, Scop., var. *prostrata*, Tabeuf). Fig. 2968. Cone regular, conical or conic-oval, with usually prickly umbos, not bloomy, yellowish brown before ripening, cinnamon-brown when ripe. Usually shrubby and prostrate. Gn. M. 2:23. Var. *aureo-variegata*, Schwerin, has some of lvs. golden yellow. Var. *gracilis*, Schwerin, is a regular pyramidal form with lvs. 1–1 $\frac{1}{4}$ in. long. M.D. 1906, p. 193.

27. *nigra*, Arnold (*P. Laricio*, Poir.). AUSTRIAN PINE. Tree, to 100 or occasionally 150 ft., with stout, spreading branches in regular whorls forming a symmetrical pyramid, in old age sometimes broad and flat-topped: branchlets usually light brown: buds ovate or oblong-ovate, light brown, resinous: lvs. stiff, acute, dark green, 3–6 $\frac{1}{2}$ in. long: cones sessile, ovate, yellowish brown, glossy, usually 2–3 $\frac{1}{2}$ in. long; apophysis depressed, conspicuously keeled; umbo flattened, obtuse or with a very short prickle; seeds gray, $\frac{1}{4}$ in. long. S. Eu. to W. Asia.—Very variable and usually the following geographical varieties are distinguished: Var. *austriaca*, Schneid. (*P. Laricio* var. *austriaca*, Endl. *P. austriaca*, Höss. *P. nigricans*, Hort.). Fig. 2969. Tall tree, with dark gray bark, broadly ovate head and very dark green, rigid lvs. 3–4 in. long: branchlets grayish or yellowish brown. S.E. Eu., from Austria to Dalmatia and Rumania. Gn. 19,



2971. *Pinus taeda* ($\times \frac{1}{4}$). No. 33.

p. 477; 38, p. 113. F.S.R. 3, p. 10. F.E. 18:376 (pl. 84). G.W. 15, p. 466, H.W. 1:6, pp. 148–51. Mn. 10, p. 170. R.H. 1894, p. 271. Var. *Pallasiana*, Schneid. (*P. Pallasiana*, Lamb.). CRIMEAN PINE. Tall tree, with long and stout branches: lvs. dark green and glossy: cones light brown, about 4 in. long. W. Asia. G.C. II. 20:785; 21:481. Var. *calabrica*, Schneid. (*P. Laricio calabrica*, Delam.). CALABRIAN PINE. Tall tree, with shorter ascending branches forming a narrower, less dense head: lvs. of lighter green: branchlets light brown. Italy, Sicily. Var. *pindica*, Rehd. (*P. Laricio pindica*, Mast. *P. pindica*, Formanek). Lvs. pale green, about 5 in. long: cones about 3 in. long with convex apophysis and small obtuse umbo. Thessaly. G.C. III. 31:304. Var. *leucodermis*, Rehd. (*P. leucodermis*, Ant.). Pyramidal tree: bark light gray, broken into angular plates: lvs. dark green, 2–4 in. long: cones oblong-ovate, light grayish brown, dull, about 3 in. long. S. E. Eu. H.W. 1, p. 158–61. Var. *Poiretiana*, Schneid. (*P. Laricio*, Poir. *P. Laricio corsicana*, Hort.). CORSICAN PINE. Tall tree, to



2972. Seedlings and young plant of *Pinus palustris*. No. 34.

150 ft., with shorter ascending branches forming a narrower head: bark gray: branchlets reddish brown: lvs. lighter green, 4–6 in. long. Corsica. R.H. 1897, pp. 355, 357. F.S.R. 1, p. 33. Gn. 27, p. 321; 29, p. 104; 36, p. 523; 52, p. 219. G.C. II. 21:15; III. 4:693, 705. Var. *tenuifolia*, Schneid. (*P. Laricio tenuifolia*, Parl. *P. Salzmannii*, Dun. *P. monspeliensis*, Salzmann. *P. pyrenaica*, Lapeyr. *P. cebennensis*, Hort. *P. horizontalis*, Hort.). Tree, to 60 ft.: branchlets orange-colored: lvs. slender, to 6 $\frac{1}{2}$ in. long: cones small, about 2 in. long. Of the horticultural varieties may be mentioned var. *pendula*, Rehd. (*P. Laricio pendula*, Beissn.); var. *pygmaea*, Rehd. (*P. Laricio pygmaea*, Rauch), a dwarf dense bushy form; var. *prostrata*, Rehd. (*P. L. prostrata*, Beissn.), of prostrate habit, and var. *Möseri*, Rehd. (*P. L. Möseri*, Moser), compact and dwarf, needles turning golden yellow in winter.—The var. *austriaca* is hardy N., the others are at least hardy as far north as Mass. They are of rapid growth and conspicuous by their large, dark green foliage. Var. *tenuifolia*

is especially very handsome as a young plant, with its long, dense lvs.

28. *Thûnbergii*, Parl. (*P. Massoniana*, Sieb. & Zucc., not Lamb.). JAPANESE BLACK PINE. Tree, to 100 ft., or occasionally 120 ft., with spreading, often somewhat pendulous branches, forming a broad, pyramidal head:



2973. Cone of *Pinus palustris* ($\times \frac{1}{4}$). No. 34.

branchlets orange-yellow, the winter buds oblong, grayish or silvery white: lvs. stiff, sharply pointed, bright green, $3\frac{1}{2}$ in. long: cones short-stalked, conic-ovate, grayish brown, 2-3 in. long; apophysis flattened, with small, depressed umbo, obtuse or with a minute prickly; seed grayish brown, $\frac{1}{4}$ in. long. Japan. G.C. II. 23:345. S.Z. 2:113. S.I.F. 1:1.—Handsome tree and hardy N. Several horticultural varieties have been intro. from Japan: one of the most distinct is var. *Oculus-draconis*, Mayr, each lf. being marked with 2 yellow bands and therefore the tufts of the lvs. at the end of the branches, if seen from above, show alternate yellow and green rings, hence the name *Oculus-draconis* (dragon-eye). Var. *variegata*, Hort., has the lvs. partly yellow or occasionally wholly yellowish white. There are also similar forms in *P. densiflora*, which may be distinguished by the brown color of the winter buds.



2974. Leaf-bundle of *Pinus palustris*. No. 34.

29. *sinensis*, Lamb. (*P. leucosperma*, Maxim. *P. funèbris*, Komar. *P. Henryi*, Mast. *P. Wilsonii*, Shaw. *P. tabuliformis*, Carr.). Tree, to 70 ft.: bark of trunk dark gray, fissured, red on the limbs: branchlets pale orange-yellow or pale grayish yellow, slightly bloomy while young: winter buds oblong, light brown, lustrous, slightly or not resinous: lvs. 2-3, oftener 2, stiff, glaucescent, with rough margins, 2-4 in. long: cones subsessile, ovoid, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long, persistent for several years, pale yellow-brown; apophysis rhombic, prominently keeled, with an obtuse or mucronate umbo; seeds brown, mottled or whitish, over $\frac{1}{4}$ in. long, with the wing $\frac{3}{4}$ in. long. Cent. and W. China. Var. *densata*, Shaw (*P. densata*, Mast. *P. prominens*, Mast.). Lvs. 3-5 in. long, stiff: cones ovoid, 2- $2\frac{1}{2}$ in. long, oblique, with their posterior apophysis tumid and prominent. Var. *yunnanensis*, Shaw (*P. yunnanensis*, Franch.). Lvs. oftener 3, slender, 4-8 in. long: cones $2\frac{1}{2}$ - $3\frac{1}{2}$ in. long; apophysis flat; umbo small; seed with wing nearly 1 in. long. S.W. China. G.C. III. 38:226.

Group 10. AUSTRALES.

30. *ponderosa*, Douglas (*P. Benthamiana*, Hartw.). YELLOW PINE. BULL PINE. Fig. 2970. Tree, to 150, occasionally to 230 ft., with stout spreading and often pendulous branches usually ascending at the ends and forming a narrow, spire-like head: branchlets orange-brown, fragrant when broken: winter buds oblong-ovate or ovate, resinous: lvs. acute, dark green, 5-11 in. long: cones almost sessile, often in clusters, ovate-oblong, light reddish or yellowish brown and lustrous, 3-6 in. long; apophysis depressed-pyramidal or flattened, with a broadly triangular umbo terminated by a stout, usually recurved prickly; lower scales with more elongated apex; seed $\frac{1}{4}$ in. long. Brit. Col. to Mex., east to Neb. and Texas. S.S. 11:560, 561. G.F. 8:395. G.C. III. 8:557, 561, 569. F.S.R. 3, p. 99. M.D.G. 1905:126.—One of the tallest and most important pines of the western states. Hardy as far north as N. Y., and in sheltered positions to Mass. Var. *pendula*, H. W. Sarg., has drooping branches. Var. *scopulorum*, Engelm. (*P. scopulorum*, Lemm.), is a geographical variety, smaller in every part; usually to 75 ft. high: lvs. 5-7 in. long, sometimes in 2's: cones smaller, ovate. S. D. to Mex. and Texas. S.S. 11:564. G.C. II. 9:797. M.D. 1912, p. 364. Somewhat harder than the type.—*P. Milletti*, Mott., is probably a form of this species with more ascending branches forming a rather narrow pyramidal head. R.H. 1913, p. 265. Fig. 2970 is adapted from Pacific R. R. Report.



2975. *Pinus caribaea* ($\times \frac{1}{4}$). No. 35.

31. *Jeffreyi*, Balfour (*P. ponderosa* var. *Jeffreyi*, Vasey). JEFFREY'S PINE. Tree, to 120 or occasionally to 180 ft., with short spreading or often pendulous branches, the uppermost ascending, forming an open pyramidal and sometimes narrow spire-like head: young branches glaucous, fragrant when broken: winter buds oblong-ovate, not resinous: lvs. stout, acute, pale bluish green, 5-8 in. long: cones conic-ovate, light brown, 6-12 in. long; apophysis depressed, keeled; umbo elongated into a slender recurved spine; seed about $\frac{1}{2}$ in. long. Ore. to Calif. S.S. 11:562, 563. G.C. II. 22:813; III. 5:361, 369. G.F. 5:185. B.M. 8257. G.W. 2, p. 199.—Distinct and ornamental pine of symmetrical habit when young, hardy as far north as Mass. Among the harder species this pine has the longest lvs.

32. *echinata*, Mill. (*P. mitis*, Michx.). SPRUCE PINE. YELLOW PINE. Tree, to 100 or 120 ft., with slender often pendulous branches in regular whorls: winter buds oblong-ovate, brown: lvs. slender, acute, dark bluish green, sometimes in 3's, 3-5 in. long: cones short-stalked or almost sessile, conic-oblong, dull brown, $1\frac{1}{2}$ -2 in. long; apophysis flattened; umbo little elevated, with short straight or curved prickly;



2976. *Pinus caribaea*. ($\times \frac{1}{4}$)

seeds $\frac{1}{2}$ – $\frac{1}{4}$ in. long. N. Y. to Fla., west to Ill. and Texas. S.S. 11:587.—Handsome tree, with broad, oval head, hardy as far north as Mass.

33. *Tæda*, Linn. LOBLOLLY PINE. OLD FIELD PINE. FRANKINCENSE PINE. Fig. 2971 (adapted from U. S. Forestry Report). Tree, to 100, occasionally to 170 ft., with spreading branches, the upper ascending, forming a compact round-topped head: branchlets yellowish brown, sometimes slightly bloomy: winter buds oblong, resinous: lvs. slender but stiff, acute, bright green, 6–9 in. long: cones sessile, spreading, conic-oblong, light reddish brown, 3–5 in. long; apophysis flattened or depressed-pyramidal; umbo small, with short triangular, recurved spine, lower scales not elongated; seed $\frac{1}{2}$ in. long. Del. to Fla. and Texas. S.S. 11:577, 578.—Not hardy N., and rarely cult. for ornament.

34. *palustris*, Mill. (*P. australis*, Michx.). LONG-LEAF PINE. SOUTHERN PINE. Figs. 2965, 2972–2974. Tree, to 100 or 120 ft., with ascending branches forming an oblong open head: branchlets orange-brown: winter buds whitish, oblong; lvs. crowded, forming tufts at the end of branchlets, dark green, 8–18 in. long, with internal resin-ducts: cones almost sessile, cylindric, dull brown, 6–10 in. long; apophysis flattened; umbo dark brown, with triangular, reflexed short spines; seed almost $\frac{1}{2}$ in. long. Va. and Fla., to Miss., along the coast. S.S. 11:589, 590. G.F. 10:115.—Very important timber tree, but rarely planted for ornament; hardy only S.



2977. Cone of *Pinus clausa* (natural size). No. 39.

Branches are imported in great quantities into the northern cities in midwinter and used for decorations on account of their large handsome foliage. Figs. 2972–2974 are adapted from U. S. Forestry Report.

35. *caribæa*, Morelet (*P. cubensis*, Griseb. *P. heterophylla*, Sudw. *P. Elliottii*, Engelm.). SLASH PINE. SWAMP PINE. Figs. 2975, 2976. Tree, to 100 or 120 ft., with horizontally spreading branches forming a round-topped broad and compact head: branchlets orange-brown: winter buds cylindric, light brown: lvs. dark green and lustrous, acute, in 3's and 2's, 8–12 in. long, with internal resin-ducts: cones short-peduncled, conic-oblong, dark brown and glossy, 3–6½ in. long; apophysis flattened, keeled; umbo small, with minute recurved prickles; seed $\frac{1}{6}$ – $\frac{1}{4}$ in. long. Ga. to Fla., near the coast, Cuba. S.S. 11:591, 592. G.C. III. 35:179. G.F. 8:223 (adapted in Fig. 2996).—Handsome pine, with compact broad head, hardy only S. Fig. 2975 is adapted from U. S. Forestry Report.

Group 11. INSIGNES.

36. *halepensis*, Mill. (*P. alepensis*, Poir.). ALEPPO PINE. Tree, to 60 ft., with short branches forming an open round-topped head: branchlets slender, yellowish or light greenish brown: winter buds small, cylindric, not resinous: lvs. sometimes in 3's, slender, light green, 2½–4 in. long: cones short-stalked, spreading or deflexed, usually 1–3, conic-ovate or conic-oblong, yellowish brown, unarmad, 2½–3½ in. long; apophysis flattened, with a transverse line and slightly or not elevated obtuse umbo; seed $\frac{1}{4}$ in. long. Medit. region.

G.C. II. 22:553; III. 3:629. G.W. 9, pp. 469, 471. H.W. 1:7, pp. 162–5.—Not hardy N. and of little ornamental value, but recommended for seaside planting. Trunk usually slender and destitute of branches for a considerable height: foliage thin and sparse, in tufts



2978. Cone of *Pinus clausa*, grown over by the branch. ($\times \frac{1}{2}$)

at the end of branchlets. Var. *Pityusa*, Gord. (*P. Pityusa*, Stev.), is a smaller tree with slenderer branches, longer lvs., and smaller cones. W. Asia. Var. *brütia*, Henry (*P. brütia*, Ten. *P. eldarica*, Medw. *P. pyrenæica*, David). Lvs. 4–7, rarely 8 in. long, more rigid, bright or dark green: cones sessile, not deflexed, usually in whorls of 2–6, 2–4 in. long with rugose depressed knobs. S. Eu., W. Asia. G.C. III. 4:268. H.W. 1, pp. 172, 173. R.H. 1867, pp. 150, 151.

37. *Pinaster*, Ait. (*P. maritima*, Poir.). CLUSTER PINE. Tree, to 100 ft., with spreading or sometimes pendulous branches forming a pyramidal head: branchlets bright reddish brown: buds oblong-oval, brown, not resinous: lvs. stiff, acute, usually twisted, glossy green, 5–9 in. long: cones short-peduncled, clustered, conic-oblong, light brown and glossy, 4–7 in. long; apophysis pyramidal, conspicuously keeled with prominent triangular, acute umbo; seed grayish brown, $\frac{1}{4}$ in. long. S. Eu., near the coast. Gn. 14, p. 20. G.W. 9, p. 470. H.W. 1, pp. 168, 169.—Handsome pine of regular, pyramidal habit and rapid growth, but not hardy N. In England it is much used for seaside planting and the vars. *Hamiltonii*, Parl., var. *Lemoniana*, Endl. (*P. Pinaster Aberdonia*, Loud.), and var. *minor*, Loisel., are occasionally cult. in English gardens.

38. *pungens*, Lamb. TABLE MOUNTAIN PINE. POVERTY PINE. Tree, to 30, occasionally to 60 ft., with stout spreading branches forming a broad open often flat-topped head: branchlets light orange: winter buds oblong, obtuse, dark chestnut-brown: lvs. stout, twisted, sharply pointed, dark green, 1¼–2½ in. long: cones conic-ovate, oblique at the base, light brown, 2½–3½ in. long; apophysis pyramidal and conspicuously keeled, the conical elongated umbo ending in a stout curved spine; seed light brown,



2979. *Pinus contorta* ($\times \frac{1}{4}$). No. 42.

$\frac{1}{4}$ in. long. N. J. to N. C. and Tenn. S.S. 11:584.—Hardy as far north as Mass., but of little ornamental value.

39. *clausa*, Vasey (*P. inops* var. *clausa*, Engelm.). SAND PINE. SPRUCE PINE. Figs. 2977, 2978. Tree, to 20, occasionally to 70 ft., with slender spreading



2980. *Pinus rigida* ($\times \frac{1}{2}$). No. 45.

branches: branchlets red-brown: winter buds oblong, obtuse, not or little resinous: lvs. slender and flexible, acute, dark green, 2-3 in. long: cones short-stalked, often oblique at the base, conic-ovate, dark reddish brown, 2-3½ in. long, remaining closed for 3 or 4 years after ripening and occasionally becoming enveloped by the growing wood of the st.; apophysis depressed-pyramidal, conspicuously keeled; umbo with a short, stout spine. Fla. and Ala. near the coast. S.S. 11:582. G.F. 5:161.—Little known in cult., and not hardy N.

40. *virginiana*, Mill. (*P. inops*, Ait.). SCRUB PINE. JERSEY PINE. Tree, to 40, or sometimes to 100 ft., with slender horizontal or pendulous branches in remote and irregular whorls, forming a broad open pyramid or sometimes flat-topped: winter buds oblong, dark brown: lvs. stiff, twisted, spreading, acutish, 1½-2½ in. long: cones conic-oblong, reddish brown, 1½-2½ in. long; apophysis little elevated, with a broad depressed-pyramidal umbo ending in a short recurved prickle; seed pale brown, $\frac{1}{4}$ in. long. N. Y. to S. C., west to Ky. and Ind. S.S. 11:581.—Hardy as far north as Mass., but of little ornamental merit. Valuable in the middle states for covering dry and barren soil.

41. *Banksiana*, Lamb. (*P. divaricata*, Dum.-Cours.). JACK PINE. Tree, to 70 ft., usually lower, sometimes shrubby, with slender spreading branches, forming broad open head: branchlets yellowish to purplish brown: winter buds oblong-ovate, light brown, very resinous: lvs. stiff, twisted, spreading, acute or obtusish, dark or bright green, about 1 in. long: cones conic-oblong, usually curved, pale yellow-brown and lustrous, unarmed, 1½-2 in. long, remaining on the tree for 12-15 years; apophysis flattened, with a transverse line and a small dark obtuse umbo; seed black, $\frac{3}{8}$ in. long. Hudson Bay to N. Y., west to Minn. S.S. 11:588.—The most northern of all American pines and quite hardy, but not of much ornamental value.

42. *contorta*, Douglas (*P. Bolanderi*, Parl. *P. contorta* var. *Bolanderi*, Koehne). SCRUB PINE. Fig. 2979 (adapted from Pacific R. R. Report). Tree, to 20, occasionally to 30 ft., with rather stout branches forming a round-topped compact or open head: branchlets light orange or orange-brown: buds ovate, dark chestnut-brown, resinous: lvs. stiff, twisted, acutish, dark green, 1-2 in. long: cones ovate or conic-ovate, very oblique at the base, often remaining closed for several

years after maturity, 1-2 in. long, light yellowish brown and lustrous, scales of the upper side with elevated, pyramidal apex, the dark umbo ending in a slender incurved spine. Alaska to Calif. and the variety east to Mont. and Colo. G.C. II. 19:45. S.S. 11:567. Var. *latifolia*, Engelm. (*P. contorta* var. *Murrayana*, Engelm. *P. Murrayana*, Balfour. *P. Boursieri*, Carr.), LODGE-POLE PINE, is the form in the Rocky Mts. and a taller tree of pyramidal habit, to 80, or occasionally to 150 ft. tall, with longer, lighter green, 1½-3½ in.-long lvs., less oblique cones. S.S. 11:518. G.C. 1869:191 and R.H. 1869, p. 278 (as *P. Tamrac*). R.H. 1854, p. 226.—In cult., it is usually a bushy low tree and is hardy N., while the typical form is tender.

43. *muricata*, Don. PRICKLE-CONE PINE. Tree, to 50, occasionally to 90 ft., with stout spreading branches forming a regular pyramid in young trees, in old age usually round-topped and compact: branches orange-brown: winter buds ovate, dark brown, resinous: lvs. stiff, usually twisted, acute, dark green, 4-7 in. long: cones usually clustered, oblong-ovate, oblique at the base, chestnut-brown, 2-3½ in. long; scales of the upper side with elongated conical apex terminated by a dark triangular spiny umbo, scales of the lower side more flattened, with slender straight spines; the cones usually remain closed for several years after maturity; seeds almost black, $\frac{1}{4}$ in. long. Calif. S.S. 11:585, 586. G.F. 10:235. F.S. 5, p. 517. G.C. II. 21:48, 49, 53; III. 45:259-61. Gn. 59, p. 129. G.M. 54:977.—Handsome pine, with regular, pyramidal head; not hardy N.

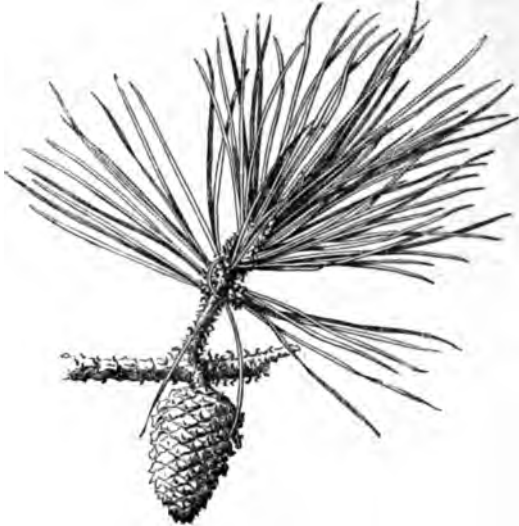
44. *serotina*, Michx. POND PINE. MARSH PINE. Tree, to 50, or occasionally to 80 ft.: branchlets dark orange-color: lvs. 3, rarely 4, slender, dark green, 6-8 in. long, with stomata on all 3 faces: cones subglobose to ovate, short-stalked or nearly sessile, rounded or pointed at the apex, light yellow-brown, 2-2½ in. long, remaining closed for one or two years after maturity; scales thin with depressed apophysis and a small slender, mostly deciduous prickle; seeds with the wing about $\frac{3}{4}$ in. long. N. C. to Fla. S.S. 11:580.—Not hardy N.

45. *rigida*, Mill. PITCH PINE. Figs. 2980-2983. Tree, to 80 ft., with horizontally spreading branches forming an open irregular pyramid: branchlets light brown: winter buds ovate or ovate-oblong, chestnut-brown: lvs. stiff and spreading, acuminate, dark green, 2-5 in. long: cones almost sessile, often in clusters,



2981. *Pinus rigida*, with young cones. ($\times \frac{1}{2}$)

ovate, light brown, 2-4 in. long; apophysis little elevated; umbo triangular, ending in a slender, recurved prickle; seed dark brown, $\frac{1}{4}$ in. long. New Bruns. to Ga., west to Ont. and Ky. S.S. 11:579. G.F. 4:402; 10:195. G.C. III. 44:178. Gn. 31, pp. 128, 132. M.D.G. 1896:301.—Hardy pine of rapid growth when



2982. *Pinus rigida*, recent cone. ($\times \frac{1}{4}$)

young and easily raised from seed; grows on dry and sterile soil. As an ornamental plant it may be used on dry and rocky slopes, where it becomes often very picturesque when older. It sprouts readily from stumps if cut down or destroyed by fire, but the sprouts are short-lived and never develop into trees.

46. *radiata*, Don (*P. insignis*, Douglas. *P. montereyensis*, Hort.). MONTEREY PINE. Fig. 2965. Tree, to 80 or 100 ft., with stout spreading branches forming an irregular open, round-topped head: bark thick, furrowed: branchlets brown: buds ovate, bright chestnut-brown: lvs. acute, bright green, 4-6 in. long: cones short-stalked, conic-ovate, upper scales with elevated, rounded, almost hemispherical and obscurely keeled apex; umbo small, with minute straight or recurved prickle, lower scales with almost flattened apex; seed black, $\frac{1}{4}$ in. long. S. Calif. S.S. 11:573, 574. F.S. 6, p. 44. G.C. III. 9:336, 341; 38:435. G. 12:263; 22:131. R.H. 1906, p. 154. Gn. 36, p. 47; 49, p. 312.—Handsome species with bright green foliage and of rapid growth and bushy habit when young; valuable for seaside planting. Not hardy N.

47. *attenuata*, Lemm. (*P. tuberculata*, Gord., not Don. *P. californica*, Hartw., not Loisel.). KNOT-CONE PINE. Tree, usually 20, occasionally to 100 ft., with slender horizontal branches ascending at the ends, forming a broad pyramid, with open round-topped head in old age: bark thin, scaly: young branches slender, dark orange-brown: winter buds oblong-ovate, dark brown: lvs. slender, acuminate, pale yellowish or bluish green, 3-7, usually 4-5 in. long: cones short-stalked, usually in clusters, elongated-conical, $3\frac{1}{2}$ -6 in. long, upper scales with pyramidal apex; umbo prominent, sharply pointed and recurved, lower scales with depressed apex and small prickly umbo; seed $\frac{1}{4}$ in. long. Ore. to Calif. S.S. 11:575,



2983. Old cone of pitch pine.—*Pinus rigida*. ($\times \frac{1}{4}$)

576. G.C. II. 24:784, 785. G.M. 56:255. F.S. 5, p. 517c.—Of little ornamental value and not hardy N. Usually a bushy tree with sparse dull foliage.

Group 12. MACROCARPÆ.

48. *Coulteri*, Don (*P. macrocarpa*, Lindl.). PITCH PINE. Fig. 2965. Tree, to 80 ft., with stout branches, pendulous below and ascending above, forming a loose pyramidal head: winterbuds oblong-ovate, resinous: lvs. stout, acuminate, dark bluish green, 6-12 in. long: cones short-stalked, pendent, cylindric-ovate, yellowish brown, 9-14 in. long; apophysis elongated-pyramidal, narrowed into the compressed spiny-tipped straight or incurved umbo. Calif. S.S. 11:571, 572. G.C. II. 23:409, 413; III. 4:765.—Not hardy N. Old trees are often very picturesque and the large cones are conspicuous and ornamental.

49. *Sabiniana*, Douglas. DIGGER PINE. BULL PINE. Fig. 2984 (adapted from Pacific R. R. Report). Tree, to 50 or occasionally 80 ft., usually divided into several sts. with short crooked branches, the lower ones pendent, the upper ones ascending, forming a round-topped head: lvs. slender, flexible, pale bluish green, 8-12 in. long: cones pendent on about 2-in.-long stalks, oblong-ovate, light red-brown, 6-10 in. long; apophysis pyramidal, sharply keeled, flattened at the straight or incurved apex, the lower scales with much-recurved apex; seeds $\frac{3}{4}$ in. long, short-winged. Calif. S.S. 11:569. G.C. III. 4:43; 5:45. F. S. 9:964.—Not hardy N. Distinct pine of loose habit and with sparse pale foliage. The seeds are edible.



2984. *Pinus Sabiniana*. (Cone $\times \frac{1}{4}$, leaves and seed $\times \frac{1}{2}$)

50. *Torreyana*, Carr. SOLEDAD PINE. Tree, to 40, or occasionally to 60 ft., with spreading and sometimes ascending branches: branchlets greenish or purplish, bloomy, glabrous: lvs. rigid, dark green, 8-13 in. long: cones broadly ovate, 4-6 in. long, chocolate-brown; apophysis low-pyramidal; umbo elongated and reflexed with short spiny tip; seeds $\frac{3}{4}$ in. long, short-winged. S. Calif. S.S. 11:557, 558.—Rarely cult.; not hardy N.

P. Abies, Linn.—*Picea excelsa*.—*P. albicaulis*, Engelm. Pyramidal tree, to 30, rarely 60 ft., sometimes shrubby, allied to *P. flexilis*: bark whitish or light brown: cones smaller, $1\frac{1}{4}$ - $3\frac{1}{4}$ in., subglobose or oval, purplish brown. Brit. Col. to Calif. and Wyo. S.S. 11:548. G.C. II. 24:9. Probably as hardy as *P. flexilis*.—*P. arizonica*, Engelm. (*P. ponderosa* var. *arizonica*, Shaw). Tree, to 100 ft., with pyramidal or open round-topped head, allied to *P. ponderosa*: lvs. shorter, 5-7 in. long: cones smaller, 2-2 $\frac{1}{4}$ in., with recurved spines. Ariz. S.S. 11:559.—*P. chihuahuana*, Engelm.—*P. leiophylla* var. *chihuahuana*.—*P. Gerardiana*, Wall. Tree, to 80 ft., with broad round-topped head, allied to *P. Bungeana*: lvs. bluish green, 2 $\frac{1}{4}$ -4 in. long: cones 6-9 in. long, with the tips of scales reflexed; seeds short-winged, to 1 in. long, edible. Himalayas. Not hardy N.—*P. glabra*, Walt. CZAR PINE. SPRAUCE PINE. Pyramidal tree, to 80, rarely 120 ft., allied to *P. echinata*: lvs. dark green, 1 $\frac{1}{4}$ -3 in. long: cones broadly to oblong-ovate, 1 $\frac{1}{4}$ -2 in. long. S. C. to Fla. and La. S.S. 11:583. Hardy only S.—*P. Gordoniana*, Hartw.—*P. Montesuma*.—*P. Grevillei*, Gord.—*P. Montesuma*.—*P. Heldreichii*, Christ. Small

tree, allied to *P. nigra*: lvs. 3-4 in. long; cone 3 in. long, with impressed dull umbo furnished with a small curved prickle. Greece. G.C. II. 21:740.—*P. insularis*, Endl. Tall tree: lvs. 3, flaccid and very slender, 7-9 in. long; cones conic-ovate, $2\frac{1}{2}$ -3 in. long; scales with low pyramidal, sharply keeled apex and obtuse or on the upper scales mucronulate umbo. Philippine Ials. Not yet intro.—*P. latifolia*, Sarg. (P. Mayriana, Sudw.) Tree, to 60 ft., allied to *P. ponderosa*: lvs. 12-15 in. long and $\frac{1}{2}$ in. wide; cones oblique at the base, 3-4 in. long. Ariz. S.S. 11:565. G.F. 2:496; 8:25. Not hardy N.—*P. latiquadma*, Engelm.—*P. Pinceana*.—*P. leiophylla*, Schlecht. & Cham. Allied to *P. Lambertiana*. Tall tree: lvs. usually 5, slender, grayish green, 4-8 in. long; cones ovoid, nearly symmetrical, 2-3 in. long, with small recurved prickles. Mex. Var. *chihuahuana*, Shaw (P. chihuahuana, Engelm.). Lvs. usually 3 or 4, stouter and shorter. Calif. to New Mex. and Mex. S.S. 11:566. G.F. 8:24.—*P. macrophylla*, Lindl., not Engelm.—*P. Montezumae*.—*P. Mayriana*, Sudw.—*P. latifolia*.—*P. Montezumae*, Lamb. (P. Gordoniana, Hartw. P. Grenvillea, Gord. P. macrophylla, Lindl., not Engelm.). Tree, to 80 ft. and more: allied to *P. Torreyana*: lvs. glaucous or green, 7-16 in. long; cones 4-14 in. long, light brown; apophysis depressed pyramidal, with a short, recurved spine. Mex. G.C. III. 8:405-7, 475; 15:271, 273. Gn. 56, p. 481; 58, p. 397. Very variable species, as the numerous (about 70) synonyms show. Not hardy N.—*P. Nelsonii*, Shaw. Allied to *P. oemboideae*. Low bushy tree to 30 ft.: lvs. with persistent sheaths 3, $2\frac{1}{2}$ -3 $\frac{1}{2}$ in. long, serrulate; cones on stout curved peduncles, cylindrical; seeds wingless. Mex. G.C. III. 38:122; 37:306.—*P. pátula*, Schiede. Allied to *P. Teda*. Tree, to 80 ft.: lvs. sometimes 4 or 5, drooping, light green, 7-9 in. long; cones oblong-ovate, oblique with depressed knobs, 4 in. long. Mex. G.C. II. 23:108, 109, 117; III. 9:435. Graceful tree, but not hardy N.—*P. Picea*, Linn.—*Abies Picea*.—*P. Pinceana*, Gord. (P. latiquadma, Engelm.). Allied to *P. oemboideae*. Low tree with slender branches: lvs. usually 3, entire, 5-6 in. long; cones oblong-ovate, long-stalked, $2\frac{1}{2}$ -3 $\frac{1}{2}$ in. long; seeds wingless. Mex. G.C. II. 18:713; III. 38:122.—*P. pumila*, Regel (P. Cembra var. pumila, Pall.). Shrubby, often procumbent, allied to *P. Cembra*, but resin-ducts of lvs. external: lvs. $1\frac{1}{2}$ -3 in. long; cone $1\frac{1}{4}$ in. long; seed $\frac{1}{2}$ in. long. N.E. Siberia to Japan. Hardy. S.I.F. 2:1. G.C. III. 46:193. M.D. 1912, pp. 159, 161.

ALFRED REHDER.

PIPER (the ancient Latin name). *Piperaceae*. **PEPPER**. A vast genus (probably 600 to 700 species) of both the Old and New Worlds, mostly in the tropics, a few of which are in cultivation as greenhouse foliage subjects and in collections of economic plants.

Pipers are mostly dioecious: erect or climbing woody plants, or sometimes herbaceous, and some are trees: fls. very minute, borne beneath decurrent bracts in slender, erect or drooping axillary spikes or catkins; perianth none; stamens usually 1-4; ovary 1-loculed, with a solitary erect ovule: fr. a small globular drupe or berry: lvs. alternate, stipulate, usually entire. The pepper of commerce is the product of *P. nigrum*. The family contains many plants with aromatic, pungent and stimulating qualities. Some of them are used in medicine, and others yield intoxicating and masticatory products. For red pepper and chilli or chile pepper, see *Capsicum* and *Pepper*. To this genus are also referred *Enckea* and species sometimes grown under the name of *Chavica*.

In choice collections, one is likely to find several species, but as they seldom fruit it is very difficult to determine their species. In the following list are all the names that have appeared in the American trade. *Piper* is an exceedingly difficult genus to the systematist because of the great numbers of species, the variation of foliage in the same plant at different epochs, the difficulty of matching the sexes of the same species, the imperfect specimens in herbaria, and the scarcity of good studies of the plants in the wild. They are easy of cultivation. Most of those known in houses require a warmhouse temperature and a humid atmosphere. Easily multiplied by cuttings of the firm wood. They are grown for the decorative value of their drooping or bushy sprays.

A. Plant erect, and bushy or arboreous.

excelsum, Forst. (*Macropiper excelsum*, Miq.; see p. 1962, Vol. IV). Glabrous shrub, reaching 20 ft. in some of its native places: lvs. aromatic, cordate-orbicular to ovate, stalked, short-acuminate, 7-9-nerved from the base, the blade 2-4 in. across: spikes short-peduncled, the staminate ones 2-3 in. long and the bracts peltate, the stamens 2 or 3; pistillate spikes shorter, the fls. usually with 3 stigmas. New Zeal. and other S. Pacific islands.—Offered in Calif. A form with yellow-

blotched or cream-colored foliage is known as var. *aureo-pictum*.

methysticum, Forst. (*P. inebrians*, Soland. *Macropiper methysticum*, Hook & Arn.). Dioecious shrub, 8-10 ft., nearly glabrous: lvs. round-oval, deeply cordate at base, acuminate at apex, slightly pubescent beneath on the nerves and on the short petiole: spikes mostly shorter than the lvs. and opposite them. Pacific islands.—From the root of this plant is made the drink known as kava, ava, yaquona.

geniculatum, Swartz (*Ardanthe geniculata*, Miq.). Shrub with swollen nodes, the branchlets glabrous: lvs. oblong or oblong-lanceolate, mostly acuminate, with several pairs of prominent veins, the petioles canaliculate: spikes or catkins 3-5 in. long, on peduncles as long as the petioles. W. Indies, S. Amer.—Offered in S. Calif.

AA. Plant climbing, or drooping when not given support.

B. Lvs. ovate-lanceolate, deciduous.

Futokadsura, Sieb. **JAPANESE PEPPER**. Clinging closely to walls by its aerial roots: lvs. ovate-lanceolate and acuminate, cordate at base, glabrous: fls. greenish: berries globose, red or brownish. Japan.—Handsome plant, withstanding considerable frost.

BB. Lvs. broadly ovate or roundish, evergreen.

nigrum, Linn. **BLACK PEPPER**. Plant woody below: st. strong, terete, emitting roots, tall-climbing, glabrous: lvs. thickish, stalked, broadly ovate-oblong or nearly orbicular, the base usually rounded and oblique, 5-9-nerved above the base, the nerves alternate: fls. sometimes polygamous but usually dioecious: fr. globose, red. Old World tropics, but now widely dispersed in warm countries. B.M. 3139.—Sometimes grown in hothouses, particularly amongst collections of economic plants. In the wild it is a strong climber, rooting at the nodes, sometimes reaching 20 ft. in height. It is reported as hardy at Santa Barbara, blooming but not fruiting. The dried berries, which are collected before ripe, are black and wrinkled, and constitute the black pepper of commerce. When the outer skin is removed from the ripe fruit, the product is white pepper. The commercial pepper comes mostly from eastern tropics.

Cubéba, Linn. (*Cubéba officinalis*, Raf.). **CUBEB**. Climbing or tree-like: lvs. glabrous, oval, short-acuminate, obliquely cordate, the upper ones smaller and oval-oblong, somewhat unlike on plants of the different sexes: peduncle glabrous, about the length of petiole or somewhat surpassing it; stigmas 4: fr. a subglobose somewhat apiculate stalked berry, resembling that of *P. nigrum*. E. Indies.—The fr. is employed in medicine.

ornatum, N. E. Br. Climbing, 10-15 ft. tall, glabrous, rooting at nodes: lvs. glabrous "and directed to one side;" petioles slender and nearly terete, the blade peltate, ovate-orbicular, with a short, rather blunt point, the nerves 7 but not prominent above and uniting in loops on the margin, the upper surface of the young lvs. shining green and covered with pinkish spots, the old lvs. duller and whiter-spotted. Celebes.

P. Bétel, Linn. **BETEL** (which see, p. 496). Climbing, nearly or quite glabrous: lvs. large and thick, ovate-oblong, acuminate, usually oblique at base, strongly 5-7-nerved: spikes often 4-6 in. long: fr. very fleshy, often cohering into a long-cylindrical mass. Eastern tropics. B.M. 3132. Lvs. of this and others chewed by natives with the betel-nut.—*P. metillicum*, Hort. (Hallier?). Lvs. thick, rounded, handsome metallic green. Borneo.—*P. officinarum*, C. DC. (*Chavica officinarum*, Hort.?) has long-elliptic somewhat sharp-pointed feather-veined coriaceous lvs. and globular united berries in a dense spike. India and Malaya.—*P. porphyphyllum*, N. E. Br. (*Cissus porphyrophylla*, Lindl., and of horticulturists). Handsome climbing foliage plant with broadly cordate-oval short-pointed lvs. that are purple beneath and bronzy green and pink-spotted along the veins above. Probably E. Indies. F.S. 14:1491. R.H. 1883, p. 560. Lowe, 59.—*P. rubronodosum*, Bull. Shrub, with red-jointed roughish sts.: lvs. cordate-ovate, somewhat blistered, silvery gray, the petiole pubescent. Colombia.—*P. rubroendium*, Hort. Climbing: lvs. cordate-ovate, acuminate, marked with rose-colored dots and streaks along the veins. Very like *P. ornatum*, and perhaps not distinct. Papua. I.H. 34:33.

L. H. B.

PIPSISSEWA: *Chimaphila*.

PIPTADÈNIA (Greek, *falling gland*; meaning obscure). *Leguminosae*. About 45 species of shrubs or trees, mostly native to S. and Cent. Amer., a few in the tropics of the Old World, similar to *Mimosa* and *Acacia*: lvs. bipinnate with numerous small lfts., rarely with few and large lfts.: fls. small, white, in axillary globose heads or cylindric spikes; petals small, equal, connate to the middle; stamens 10, free; pod broadly linear, 2-valved, not septate within and not pulposus. The following species has been intro. to Calif. by Francischi chiefly for its economic interest; in its native country it is valued for tan bark. Prop. by seeds. *P. Cebil*, Griseb. (*P. macrocarpa* var. *Cebil*, Chodat & Hassler). Tree, to 60 ft., glabrous: lvs. with 10-16 pairs of opposite pinnae, each with 24-40 pairs of linear-oblong acutish lfts. about $\frac{1}{2}$ in. long; petiole about 1 in. long with a conspicuous gland near the middle: fl.-heads globose, axillary, 1-4, $\frac{1}{2}$ in. across, on slender pedicels $\frac{3}{4}$ -1 in. long; stamens long-exserted: pod 6-8 in. long, about $\frac{3}{4}$ in. wide, sinuate between the seeds. Argentina.

The following three species have been recently intro. by the Dept. of Agric.: *P. communis*, Benth. (*Acacia gonocantha*, Mart.). Prickly tree or shrub sometimes sarmentose: branchlets puberulous, angled, older branches sometimes developing corky wings; prickles small: lvs. with 5-12 pairs of pinnae, each with many oblique, falcate, linear lfts.: fl.-spikes 2-3 in. long, solitary or 2-3 in the axils or sometimes crowded at the end of the branches; ovary glabrous: pod linear, 3-4 in. long, reticulate, with scarcely thickened margin. Brazil. Fl. Brasil. 15, 2:74.—*P. macrocarpa*, Benth. (*Acacia grata*, Willd.). Unarmed tree: branchlets and petioles grayish tomentulose: lvs. about 6 in. long, with 10-25 pairs of pinnae, each with many oblique linear lfts. scarcely 1 line long: fl.-heads peduncled, globose, many-fl., 2-4, axillary, sometimes crowded at the end of the branchlets: pod 4-10 in. long, $\frac{1}{2}$ -1 in. broad, with thickened margin. Brazil, Bolivia.—*P. rigida*, Benth. (*Acacia Angico*, Mart.). Unarmed tree or shrub, nearly glabrous: lvs. with 3-6 pairs of pinnae, each with many oblique linear, falcate, lustrous lfts. about $\frac{1}{2}$ in. long: fl.-spikes axillary, 1-1 $\frac{1}{2}$ in. long; ovary glabrous: pod linear, to 5 in. long, with slightly thickened margin. Brazil. It furnishes the Angico gum similar to gum arabic; the bark is rich in tannin.

Other species, known as acacias, are likely to appear in cult. *P. chrysotachys*, Benth. (*Acacia chrysotachys*, Sweet). Unarmed tree, puberulous: pinnae 3-6 pairs; lfts. 8-15 pairs, oblong, obtuse, nearly $\frac{1}{2}$ in. long; spikes solitary or 2, dense, 3 in. long; calyx and corolla grayish pubescent. Madagascar. The wood is used by the natives for musical instruments.—*P. latifolia*, Benth. (*Acacia fruticosa*, Mart.). To 4 ft. high: lvs. bipinnate, glabrous, with 2 or 3 obovate-elliptic lfts.: fl.-spikes axillary, or terminal panicles. Brazil.—*P. peregrina*, Benth. The *Acacia microphylla*, Willd., is referred here. It is unarmed: pinnae 25 pairs; lfts. 50-60 pairs, linear, acute, ciliate; large gland at base of petiole: branches and petioles pubescent: heads pedunculate, twin, in the axils: pod linear, 9 in. long. Brazil to Trinidad.

ALFRED REHDER.†

PIPTÁNTHUS (Greek, *to fall*, and *a flower*; the teeth of the calyx, petals, and stamens fall off soon). *Leguminosae*. Two shrubs natives of the mountains of southern Asia, grown for ornament.

Plants 3-10 ft. high: lvs. digitately 3-foliate: fls. racemose, bracted; calyx campanulate, 5-toothed; teeth equal, lanceolate; corolla 3 times longer than the calyx; petals all with long claws; standard orbicular, erect, margins reflexed; wings obovate; keel obovate-oblong, connate down the back, slightly incurved; stamens free; anthers uniform; ovary linear, stalked, downy, 6-10-ovuled; style filiform, incurved; stigma minute, terminal: pod linear, flattened, continuous within. Closely related to *Baptisia* and *Thermopsis*, from which it is at once distinguished by having its stipules opposite-connate instead of free or wanting as in those genera. As yet but little known in U. S.

A. Lvs. glabrate on both sides.

nepalensis, D. Don (*Baptisia nepalensis*, Hook. *Thermopsis nepalensis*, DC.). Shrub 6-10 ft. tall: branches downy: stipules small, connate; petiole 1 in. or less; lfts. glabrescent, lanceolate, 2-4 in. long, narrowed to both ends: fls. 12-20 in rather dense racemes; bracts large, deciduous; calyx downy, deciduous from the base: corolla yellow, 1 in. or more long: pod 2-5 in. long, 3-10-seeded. Temperate slopes of Himalayas,

7,000-9,000 ft., and in Yunnan. R.H. 1914, p. 9. G.C. III. 43:178. J.H. III. 43:250. H.U. 1:260.—An attractive ornamental of the habit of *laburnum*. Flowers in May in the Middle States. Recently re-intro. from W. China; probably not hardy north of Washington, D. C. Prop. is by seeds sown in spring; if sown early in the greenhouse, the plants will sometimes bloom the same year; also prop. by soft-wood cuttings under glass in spring or early summer.

AA. Lvs. reddish tomentose beneath, silky above and becoming glabrate.

tomentosus, Franch. Slender shrub 3-7 ft. tall: young branches tomentose, brownish glabrescent with age: lfts. ovate to ovate-lanceolate, before flowering silky-white above, beneath pale reddish tomentose, nearly glabrous above with age: fls. similar to the above species but calyx with long silky hairs and sepals more acuminate: pod narrowly linear, about $\frac{1}{4}$ in. wide and 2-3 $\frac{1}{2}$ in. long, at maturity densely short-tomentose, 5-8-seeded. Wooded mountain slopes of Yunnan, China.—More beautiful and much more hardy than *P. nepalensis*, producing an abundance of fls. in April to May in the Middle States. Its white silky hairs give it a distinctive silvery appearance. P. L. RICKER.

PIPTÚRUS (Greek, *fallen tail*, in allusion to the inflorescence of some species). *Urticaceae*. Erect, dioecious trees or shrubs: lvs. alternate, 3- or 5-nerved; stipules bifid: fls. in axillary clusters or the clusters spicately arranged; male fls., perianth 4-5-fid, lobes valvate; stamens 4 or 5; female fls. on a somewhat fleshy receptacle, perianth ovoid, narrowed to a minute mouth; ovary adherent to the perianth: achenes small, surrounded by the accrescent fleshy perianths, forming a soft and fleshy fruit.—About 12 species, Mascarene Isls. to Malaya, Austral., and Polynesia. *P. argenteus*, Wedd. Tree, 18-20 ft.: lvs. up to 8 in. long and 4 in. broad, oval-acuminate, recurved at the top, entire, dark green with silvery white marking on the upper surface, silvery white on the under surface: fls. in sessile glomerules, inconspicuous. Malaya, Austral., and Polynesia. G.W. 7, p. 111. This has been intro. in botanic gardens.

PIQUERIA (A. Piquer, Spanish physician of 18th century). *Compositae*. Under the name of *Stevia serrata* or *S. serratifolia*, florists grow *Piqueria trinervia*, Cav. (Fig. 2985), for its small white fragrant fls. and for bedding. It is native in Mex., Cent. Amer., and Hayti. It is perennial. The genus contains about 20 species of herbs or bushes, all of Trop. Amer. They have exclusively tubular fls. in densely cymose heads, the heads containing 3-5 whitish fls.; torus plane or convex, naked; pappus none or very short: achene 4-5-angled. It resembles a small eupatorium in foliage and fls. The small heads are borne in small paniced corymbs, each cluster terminating a slender axillary branch or peduncle. The lvs. are opposite, lanceolate to oblong-lanceolate, serrate-dentate, very short-stalked. There is a dwarf, compact form, var. *nana*, Hort., and also one with broadly white-edged lvs., var. *variegata*, Hort., Fig. 2986, which are much used for bedding out. The Cent. American var. *luxurians*, O. Kuntze, has slightly larger heads but does not appear to have been intro. into



2985. *Piqueria trinervia*. Known to florists as *Stevia serrata*. (X $\frac{1}{4}$)

horticulture. The piqueria endures both sun and shade, and thrives with even indifferent treatment. For fls. it is much prized in winter, when delicate white sprays are not abundant. It demands the general treatment given zonal geraniums. Prop. by cuttings with great ease, and may begin to bloom when only 2 or 3 in. high. It often blooms in the cutting-bed. It also grows readily from seeds, which are handled by seedsmen. Frequent pinching will keep the plants within bounds and contribute to floriferousness. Plants allowed to grow as they will soon become straggly and wiry. For winter bloom the plants may be handled in pots or grown in beds. A stock of compact pot-plants kept in a cool corner is very useful for filling vacancies in the house.



2986. Marginate form of
Piqueria trinervia.

Cultivation of piqueria (by Wm. Scott).—Usually the best way to produce good flowering plants of stevia in midwinter is to save a few old plants after the flowers are cut at New Years. Cut off the old stems 5 or 6 inches above the pots and stand the plants in any cool house. The plant needs the coolest house at all times; 40° at night during the winter will grow it better than a higher temperature, but, for all that, it does not endure the slightest frost. About March 1, these old plants will have sent out any number of small growths from the base of the stems. These root very readily in a cool propagating-house. They should then be grown along, first in 2- and afterward in 3-inch pots, until the first of June, when they should be planted out in the open ground. It need not be very rich ground, for they are very rampant growers. Give every plant 2 feet of space. They seldom need any artificial watering in summer, but they should have frequent pinching to produce bushy plants. The more shoots, the more flowers will be secured. Before there is any danger of frost in the fall, the plants should be lifted and put into 6-, 7-, or 8-inch pots. They lift well, and if stood in the shade and kept syringed for a few days they will show no bad results of the lifting. A position at the north side of a shed or wall is much better for them for the next month than under glass, but always have them in a position where they can be protected in case of a frost. By the end of October, if frost is escaped, put them in the lightest and coolest house available. If kept cool the very desirable sprays of flowers will be in perfection at Christmas, and that is the time they are most valuable. Although classed as a common cheap flower, there is a grace about stevias that makes them indispensable for many flower arrangements.

PIRCUNIA: *Phytolacca*.

L. H. B.

PISCIDIA (Latin for fish and kill). *Leguminosæ*. One or 2 species, including the fish-poison tree of the American tropics, or Jamaica dogwood. The lvs., bark, and twigs of this tree when thrown into the water intoxicate or stun the fish so that they can be caught readily. (For the plant used in China for this purpose, see *Cocculus*.) The bark has also been used in medicine for its hypnotic effect. Botanically this genus is close

to *Lonchocarpus*, differing mainly in the pod, which is long, thickish, and longitudinally 4-winged: calyx-teeth 5, short, broad: wings adhering to the falcate keel; vexillar stamen free at the very base, but grown together at the middle with the others into a closed tube; ovary sessile, many-ovuled.

Erythrina, Linn. (*P. piscipula*, Sarg. *Erythrina piscipula*, Linn. *Ichthyomethia piscipula*, Hitchc.). FISH-POISON TREE. JAMAICA DOGWOOD. Lfts. 7-11, opposite, oblong or elliptical, pointed or blunt: fls. purplish white, $\frac{1}{2}$ in. across: pod 2-4 in. long, 4 lines broad; seeds 6-8, black. Trop. Amer., especially common in Jamaica.

P. L. RICKER.

PISONIA (named after Willem Piso, a physician and naturalist of Amsterdam, who died in 1648). *Nyctaginaceæ*. Erect or rarely subscandent trees and shrubs: lvs. opposite or subverticillate: infl. terminal, axillary or lateral clusters; fls. dioecious, rarely monœcious or hermaphrodite, pink, greenish or yellow; perianth 5-toothed; stamens 6-10; ovary elongate-ovoid, sessile: fr. an elongated utricle often bearing at its base the persistent filaments enveloped in the calyx and becoming fleshy, smooth or covered with spiny glands. About 80 species, mostly natives of Trop. and Subtrop. Amer. but a few in Asia, in the Mascarene Isls., and Polynesia. *P. Brunoniæ*, Endl. A tree reaching a height of nearly 50 ft.: lvs. alternate, oval-oblong, up to 10 in. long and 4 in. broad, acuminate, entire or sinuate; petiole somewhat thick, up to 1 in. long: fls. very inconspicuous in spreading terminal cymes. Tahiti and Marquesas Isls. Intro. in Belgian gardens. This species has been referred to both *P. umbellifera*, Forst., and *P. inermis*, Forst., not Jacq. The most recent treatment by Rock, "The Indigenous Trees of the Hawaiian Islands," regards it as a synonym of *P. inermis*. The following species are also reported as having been in cult.: *P. aculeata*, Linn., *P. inermis*, Forst., not Jacq. (*P. grandis*, R. Br.), and *P. obtusata*, Jacq., but apparently are not now grown.

PISTACIA (derived indirectly from ancient Persian *pista*). *Anacardiaceæ*. Trees or shrubs which exude turpentine or mastic. One species of the genus, *P. vera*, produces the pistachio-nuts or pistache of commerce which are used in confectionery and flavoring, and some of the other species are used for ornamental planting and as stock on which to graft the commercial species.

Leaves alternate, evergreen or deciduous, 3-lvd. or even- or uneven-pinnate: infl. paniculate or axillary, racemose; fls. small, dioecious and without petals; males with 5-divided or -parted calyx and 5 stamens; females with 3-4-divided or -parted calyx, short 3-divided style and 1-celled ovary: fr. a dry drupe.—About 20 species, Medit. region to Asia, with one species from the Canaries, and one from Mex., which has also been found in Calif. The so-called nut of Pistacia is really the seed or kernel of a dry drupe. The seed is green, and has a highly peculiar flavor. *P. Terebinthus* exudes from its st. the fragrant Cyprian or Scio-turpentine used in medicine as early as the time of Hippocrates.

Cultivation of the pistachio, or pistache. (G. P. Rixford.)

Several species of Pistacia, *P. vera*, *P. atlantica*, *P. Lentiscus*, *P. mutica*, *P. Terebinthus*, *P. chinensis*, *P. mexicana*, *P. integerrima*, and *P. verestina*, a hybrid, have been introduced into this country by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture and are being tested as stocks upon which to work the best varieties of *P. vera*. The cultivated species of pistache is indigenous to Asia Minor, Syria, and Palestine. It was first brought to Rome, according to Pliny, by Vitellius, then governor of Syria, during the reign of Tiberius early in the first century of the Christian era and was then carried to

Spain by Flavius Pompeius. The first introduction into the United States dates from an importation of nuts by the Federal Patent Office in 1853-1854. These nuts were widely distributed throughout the middle and southern states but do not seem to have attracted much attention until trees were introduced into California by the writer, from southern France in 1876, and subsequently by the United States Department of Agriculture at various times up to the present.

The best named varieties, a half-dozen in number, have been imported from Syria, Sicily, and other Mediterranean countries and have been extensively propagated at the Government stations, chiefly at Chico, California. During the past seven or eight years, budded trees of the named varieties and seedlings of various species to the extent of 25,000 or 30,000 have been distributed to sections of the southwestern states, chiefly California. The best nuts in market are from the island of Sicily, where wild *Terebinthus* trees are thinned out and grafted with *P. vera* cions.

In this country, the tree is propagated by either budding or grafting. In nursery rows the stocks are budded when one year old. One experienced nurseryman has best success by the use of dormant buds from old wood inserted in April or May when the bark peels freely. He sometimes takes buds in winter and keeps them in cold storage until ready for use. All the species mentioned above are successfully used for stocks, some, however, give the preference to *P. Terebinthus*, *P. vera*, *P. mulica*, and *P. atlantica*.

The trees may be worked either in nursery or in the orchard when the seedlings are well established. In planting the orchard, it is best to put out trees one year from the bud or one or two years from the seed, as the tap-root is large and young trees are most successfully moved.

It is suggested that one form of the commonly cultivated pepper tree, *Schinus terebinthifolius*, is so closely related to the pistache that it may be used as a stock for *P. vera*. The vigor, hardiness, and rapid growth of *P. chinensis* seemed to indicate it as an ideal stock upon which to work *P. vera*; but the growth of the bud the first year was a disappointment, as when it began to grow the stock in most cases stopped, resulting, at the end of the season, in a top-heavy tree, frequently $\frac{3}{4}$ inch above and $\frac{1}{2}$ inch below the union. However, the second or third year, the stock overtakes the bud, so that the only precaution required is to stake the tree the first year or two.

The pistache is a dry-climate tree, somewhat harder than the fig and olive. When once established in good deep soil, little irrigation is required. It flourishes in the southwestern states wherever the climate permits the growth of the olive. The trees are planted 25 feet apart, and one male to six or seven females must be put out as pollinizers. The males of *P. vera* blossom first and in some countries these flowers are gathered and preserved in a dry place until the female flowers open; the pollen is then dusted over them. Sometimes twigs of staminate flowers are cut from the tree and pushed into pots of moist earth where they will keep fresh a few days until the pistillate flowers open. *P. atlantica* male flowers open earlier than the female flowers of *P. vera* and have served as good pollinizers for the latter. In that case, of course, the seeds of such crosses, if planted, would produce hybrid trees. Sometimes the male cions are grafted into female trees. The male trees are invariably larger and more vigorous than the females.

The grafts begin to bear the fourth year, and at the age of eight to ten years, with good care, should yield twenty-five to one hundred pounds of nuts in the shell, of which it takes three pounds to make one of shelled kernels, in which form most of them are imported. There are seedling trees in California eight and nine years of age which are producing annually twenty to

twenty-five pounds of nuts. It is the highest-priced nut in our markets, selling at wholesale from 35 to 75 cents a pound. It is a curious fact, not mentioned by botanists, that the shells grow to about normal size and remain empty if not pollinized. After pollination the ovule rapidly expands and fills the shell.

In central California, seeds are planted in March. The seeds should be soaked over night in lye-water made with a can of lye to twenty gallons of water; then put into a coarse sieve and rub with a piece of burlap to remove the pulp. If this is not done, the seeds will be long in germinating. Plant in good soil in house or hotbed.

The pistache nut is greatly appreciated in the countries bordering on the Mediterranean, especially in Syria, where it is extensively used, as is the almond and walnut in this country. In Syria it always forms an important ingredient of all wedding feasts. The parting guest after a social call is always provided with a bag of nuts. At present, in this country, owing to the high price, its use is restricted to confectioners who use it for coloring and flavoring. When processed as are salted almonds, but in the shell, they are widely liked. The dehiscent shell is penetrated by the salt-water, while the crack facilitates the opening by the fingernails. It is not presumed that growing the nuts will become an important industry; still, as the tree is a good bearer and thrives in hot arid regions where the filbert and walnut cannot be grown, it will probably have a place in nut-production not now occupied by other species. It is not segregated by the customs authorities from other nuts, but dealers estimate the annual importations into the United States at a value of \$250,000.

The cultivated species of Pistacia.

Terebinthus, Linn. A small tree: lvs. deciduous; lfts. 9-13, mucronate; the petiole slightly winged; fls. small, in axillary panicles; stamens purplish; stigmas red; fr. small, orbicular, slightly flattened, dark purple, and wrinkled. Medit. region.—It produces a transparent gum from incisions, and in hot countries it exhales a penetrating resinous odor in the evening.

atlantica, Desf. Tree up to 60 ft. in height and 12 ft. circumference: lvs. deciduous, odd-pinnate; lfts. 7-11, alternate, lanceolate, obtuse, glabrous and sessile; petiole narrow-winged; pistillate fls. in loose, axillary racemes; staminate fls. axillary and more compact. Sahara region.—It exudes a gum similar to that of *P. Lentiscus* and *P. Terebinthus*. Its heartwood is brown, resembling walnut. Preferred by some as stock for *P. vera*.

chinensis, Bunge. CHINESE PISTACHIO. Tree, 50-60 ft. high: lvs. deciduous, odd-pinnate; lfts. 5-6 pairs, short-petiolate, lanceolate; infl. compositely branched panicles: fr. an obovoid-rotundate drupe, compressed and about $\frac{1}{4}$ in. long and broad, scarlet turning purplish. China.—Used as stock for *P. vera* and also said to be a good shade tree in Fla. and useful for ornamental planting, being rapid-growing and the foliage coloring finely in the late fall.

integerrima, Stew. Medium-sized tree: lvs. aromatic, even- or uneven-pinnate, finely pubescent when young; lfts. 4-5 pairs, usually opposite, lanceolate from an oblique base; the petiole very short; drupe broader than long, $\frac{1}{4}$ in. diam. March-May. Himalayas.—Yields the zebra wood of India. It is said that the seeds must pass through the intestines of a fowl before they will germinate; tree also said to have promise as an ornamental and perhaps even as a timber tree in some parts of the S. W. Little known in cult.

Lentiscus, Linn. Small evergreen tree, often shrubby, up to 12-15 ft.: lvs. even-pinnate with winged petioles; lfts. 3-5 pairs, coriaceous, glossy green above, light green below, ovate, obtuse; drupe about 1 in. diam., orbicular, slightly apiculate, reddish finally black at maturity. Medit. region.—In Algeria, it forms dense

copses along the coast of 15,000 hectares in extent. It is the mastic tree of the island of Chios. The gum is obtained by making transverse incisions in the bark. This gum is in constant use by Turkish and Arab women in the harems under the impression that it whitens the teeth and perfumes the breath. Oil is pressed from the seeds, one hundred kilos producing twenty litres of oil. It is used by the Arabs for food and lights. The flexible twigs are used by the same people for baskets.

mexicana, HBK. A small shrub or tree: lvs. odd-pinnate on a somewhat winged or angled slightly hairy petiole; lfts. 9-12 pairs, ovate or cuneate, obtuse, glabrous, $\frac{1}{2}$ in. long, oblique at the base; fls. in axillary panicle spikes fr. $1\frac{1}{4}$ -2 lines diam., smooth and somewhat compressed. Mex. and Calif.—A very ornamental shrub or small tree, sparingly in cult.

matica, Fisch. & Mey. Tree up to 35 ft. high: the bark dark brown with longitudinal fissures: lvs. deciduous, odd-pinnate; lfts. 2-4 pairs, oblong or oblong-ovate, obtuse; the petioles marginate or slightly winged, puberulent; drupe $1\frac{1}{4}$ in. long, obovate, flattened, obliquely apiculate. Asia Minor.—The heartwood is dark brown and very hard. Some cultivators dislike it as a stock for *P. vera*, finding difficulty in making the grafts take.

vera, Linn. **PISTACHIO**. Small tree up to 30 ft. high, with spreading branches: lvs. pinnate, at first tomentose, then glabrous, somewhat coriaceous, borne on angular petioles; lfts. 1-5 pairs, ovate, obtuse, nearly sessile (in one variety in cult. in Calif. the lvs. have only 3-5 lfts.): drupe ovoid, oblong, pedicelled, reddish and wrinkled. Medit. region and Orient.—The kernel has a rich, oily, agreeable flavor and in different varieties is either pale green or creamy yellow.

F. TRACY HUBBARD.

PÍSTIA (probably from Greek, *pistos*, watery; referring to its aquatic nature). *Ardeez*. **WATER-LETTUCE**. **TROPICAL DUCKWEED**. A small tender, perennial floating herb desirable for aquaria.

Flowers unisexual; spadix without appendage, adnate to the back of the spathe; male fls. in whorls, with 2 very short stamens which are much grown together and inserted at the apex of the spadix; female fls. solitary; ovary 1-celled; ovules numerous, orthotropous, in 4-6 series: fr. baccate, irregularly breaking open, normally with many seeds. Botanically, the genus *Pistia* is unique. The monographer of the aroids (Engler, in DC. Monogr. Phaner. 2, 1879) makes *Pistia* the sole representative of a subfamily, one of his 10 primary natural divisions of the arum family. He regards the pistias as all one species, though 9 or more have been described. He recognizes 4 well-marked varieties, based upon the shape of the lvs., which he calls *cuneata*, *spatulata*, *obcordata* and *linguiformis*. After the continental fashion Engler takes no one of these as a type to which the others are referred. It is probable that the form with obcordate lvs. is the one chiefly cult. in American water-gardens. It forms a loose rosette of lvs. and has long slender feathery roots. The plant sends out runners on which may sometimes be seen young plants in all stages of development. A healthy plant measures about 6 in. across. The lvs. are generally more or less wedge-shaped, 2-5 in. long, pea-green, velvety to the touch, and covered beneath with a sort of mealy down. The pistia rosette has been compared to a half-grown lettuce plant before the head has formed. Like many other aquatics, the water-lettuce has an immense range. It is found in fresh waters throughout the tropics, and in the U. S. is native from Fla. to Texas.

Water-lettuce is commonly grown outdoors in summer in collections of tender aquatics, and also in aquaria. The summer temperature of the water should be 70° to 80° F. Although it grows well when floating free in several feet of water, it seems to do better when

placed in shallow water where the roots may reach the soil. Larger-sized plants may be secured by using a thin layer of rich soil or well-rotted manure in the bottom of the vessel. Soft water is said to be essential. Running water is not necessary. The plants should be shaded during the middle of the day in summer, or the foliage is likely to become yellow and sickly-looking.

Stratiotes, Linn. **WATER-LETTUCE**. **TROPICAL DUCKWEED**. Tender perennial aquatic herb already described. The small white fls., though inconspicuous and borne at the bottom of the cup of lvs., are large enough to show at a glance their relation to the arum family. B.M. 4564. F.S. 6:625. J.F. 2:137. Var. *spatulata*, Engler. Lvs. spatulate, velvety green, more deeply nerved than the type. S.E. U. S., Trop. Amer.

WILHELM MILLER.

PISUM (Greek and Latin name of pea). *Leguminosae*. Mostly tendrill-climbing herbs of the Medit. region and eastward, one of which is the common pea.

Hardy annuals or perennials of easy culture, growing well in the cooler months: calyx-tube oblique at the base, the lobes more or less leafy; standard obovate or

orbicular; wings adhering to the keel; style mostly rigid, widened above, bearded down the inner margin: lfts. 1-3 pairs, the lf. ending in a tendril or point, the stipules conspicuous.—Species about a half dozen.

sativum, Linn. **GARDEN PEA**. Fig. 2987. Annual, glabrous and glaucous, tendrill-climbing: stipules large and leafy (usually as large as lfts.): lfts. oval or ovate, 2-3 pairs, the lf. ending in tendrils; fls. few,



2987. *Pisum sativum*. ($\times \frac{1}{2}$)

on an axillary peduncle, white: seeds globular. Eu., Asia.—The pea runs into many forms, which have been variously named. Two major types of garden peas are those grown for the seeds (shelling peas) and those grown for the edible pods (sugar peas). See *Pea*.

Var. *arvense*, Poir. (*P. arvense*, Linn.). **FIELD PEA**. Fls. usually bluish, light lilac, or dull white, with purple wings, and greenish keel, 1-3 on peduncle about as long or little longer than stipules: seeds angular, often gray. Grown for forage.

Var. *saccharatum*, Hort. **SUGAR PEA**. Fls. mostly in 2's: pod large and soft, more or less fleshy, sweet, not dehiscing, edible.

L. H. B.

PITANGA: *Eugenia uniflora*.

PITCAIRNIA (W. Pitcairn, a London physician). *Bromeliaceae*. Billbergia-like very short-stemmed perennial herbs or subshrubs.

Leaves in dense rosettes, narrow, often prickly-margined: infl. a central spike or raceme of long-tubular red, yellow or nearly white fls.; fls. perfect; sepals 3, free; petals 3, unguiculate, erect or spreading at the apex, usually with 2 small scales at the base; stamens 6, free, with linear anthers: fr. a 3-valved caps., with numerous seeds.—Mez, the recent monographer of the bromeliads (in DC. Monogr. Phaner. 9), admits 134 species of Pitcairnia. See also Baker in Journ. Bot.

1881. They are American, mostly tropical. In choice collections, various species of pitcairnia may be expected, but very few of them are in the American trade. For pictures of two Mexican species, *P. Jaliscana* and *P. Palmeri* (not cult.), see G.F. 1:197 and 211. *P. farinosa* is an undetermined trade name. For other species, see *Puya*. For cult. of pitcairnia, follow advice given under *Billbergia*.

A. Infl. on a scape.

B. Fls. pendulous.

corallina, Lind. & André. Stemless; outer lvs. hard and dry, without marginal spines, the inner ones with brown-spined petioles and broad plicate recurved blades which are somewhat scurfy on the back: peduncle about 1 ft. long, bright red, the raceme of about equal length and drooping: fls. coral-red, about 3 in. long, the calyx part comprising about one-third of this length; stamens as long as the petals, with white filaments; stigmas twisted. Colombia. R.H. 1875:250. B.M. 6600.—Perhaps the best species.

BB. Fls. erect.

Moritziana, Koch (*P. Klotzschiana*, Baker). Stemless: lvs. linear, in a rosette, 12–18 in. long, usually spineless and the petiole short or none: raceme 1 ft. or less long, on a leafy peduncle of about the same length; fls. red or yellowish, usually not 3 in. long. Venezuela. R.H. 1903, p. 175.

AA. Infl. sessile.

heterophylla, Beer (*P. Morrenii*, Lem. *Puya heterophylla*, Lindl.). Stemless: lvs. of two kinds, the outer ones narrow and spiny, brown, and being the termination of bulb-like scales, the later ones being longer (16–24 in.) and green and entire: fls. rose or white, in a close oblong spike that is shorter than the green lvs., the latter arising, however, from separate shoots. Mex. to Venezuela and Ecuador. B.R. 26:71. J.F. 3:291.—Odd.

Var. **exscapa**, Mez (*P. exscapa*, Hook.). Differs in its intense purple-red fls. Ecuador. B.M. 4591. J.F. 2:151.

P. alptaria—*Puya*.—*P. czerulea*—*Puya*.—*P. echinata*, Hook. Lvs. of two kinds, the one scale-like, the other normally developed, up to 3 ft. long and 2½ in. wide, spiny; panicle bipinnate; sepals acute, keeled, echinate with stellate hairs; petals yellow. Colombia. B.M. 4709. J.F. 4:407.—*P. fiammea*, Lindl. Lvs. up to 3 ft., and 1½ in. broad, linear-ensiform, entire: racemes densely many-fld., on a scape; sepals acute; petals red. Brasil. B.M. 7175 (as *P. Roesslii*).—*P. Funckiana*, A. Dietr. Lvs. 1–2 ft. long, 2 in. wide lanceolate, glabrous, unarmed: fls. in a lax raceme on a manifest scape; sepals obtuse; petals white. Guiana and Colombia. Gt. 4:44. B.M. 4705 (as *P. macrocalyx*).—*P. Jacksonii*, Hook.—*P. punicea*.—*P. Karwinskiana*, Schult. Lvs. of two kinds, the one persistent, setiform, the other normal, deciduous when old, up to 1 ft. long, and ½ in. broad, unarmed, glabrous, grass-like: raceme few-fld., on a manifest scape; sepals acute; petals red. Mex.—*P. Micheliiana*, André. Tufted, stemless: lvs. linear, channeled, 2 ft. or more long: scapes tall, bearing spikes of scarlet-red fls. Mex. R.H. 1901:576.—*P. punctata*, Scheidw. Lvs. up to 10 in. long, less than ½ in. wide, narrowly linear-lanceolate, longly acute, glabrous above, pale scaly beneath: raceme on a scape, several-fld.; sepals obliquely acute, scaly; petals brick-red. Mex. J.F. 2:127. B.M. 4540 (as *P. Jacksonii*).—*P. recurvata*, Koch. Lvs. 2 ft. long, 1–2 in. broad, lanceolate, minutely serrulated toward the tip: fls. in dense raceme, 4–6 in. long, milk-white. Brasil.—*P. ringens*, Klotzsch & Link. Lvs. of two kinds, the one brown, awl-shaped, the other grass-like, 2½ ft. long, about ½ in. broad, unarmed except at base, glabrous: raceme few- to several-fld., on a manifest scape; sepals acute; petals red. Mex. Gt. 2:53.—*P. spathacea*, Griseb.—*Puya spathacea*, Mez.—*P. suarolensis*, Lindl. Lvs. up to 18 in. long, and about ½ in. broad, narrowly ensiform, unarmed, green: raceme dense, on a manifest scape; sepals very acute; petals yellow. Brasil. B.R. 1009.—*P. tabulariformis*, Lind. Lvs. up to 6 in. long, 1¼ in. wide, oblong-spatulate: infl. globose, head-like, sessile; sepals acute; petals red. I.H. 9:344. F.M. 5:297. B.M. 8410.—*P. undulata*, Scheidw. Outer lvs. triangular, brown, entire, the inner ones few, up to 2 ft. long, ½ in. wide, unarmed, undulate, pale scaly on back: raceme many-fld., on a manifest scape; sepals acute, scaly, becoming glabrous; petals red. S. Brasil. F.S. 2:162 (as *P. Altensteini*). Gt. 781.

GEORGE V. NASH.†

PITCHER PLANTS are various carnivorous plants bearing pitchers which in some cases contain a secreted liquid by the aid of which the plant digests the bodies of insects. The native pitcher plants of the

northern and southern states are *Sarracenias*. The California pitcher plant is described under *Darlingtonia*. The favorite pitcher plants of greenhouses are *Nepenthes*. All these plants have a morphological resemblance in their pitcher-bearing foliage, but their flowers and seeds are so apparently unlike that they suggest derivation from widely different parts of the vegetable kingdom. The genus *Nepenthes* might possibly be derived from the *Aristolochia* family, being a derivative along one line, while the parasitic *Cytinaceae* might be regarded as having degenerated along another line from the same source. The Australian genus *Cephalotus*, which has a pitcher strikingly like the pitchers of *Nepenthes*, may be an outlying relative of the *saxifrage* family. *Sarracenia*, *Darlingtonia*, and the Venezuelan genus *Heliamphora* seem to be more closely allied to one another than to the others, and they make up the *Sarraceniaceae*. See the different generic entries for fuller accounts.

PITHECOCTENIUM (Greek, *monkey's comb*; alluding to the spiny fruit). *Bignoniaceae*. Ornamental vines cultivated for their showy flowers.

Evergreen shrubs climbing by lf.-tendrils: young branches ribbed: lvs. opposite, 3-foliate or the middle lf. replaced by a filiform 3-parted tendril: fls. in terminal racemes or panicles; calyx campanulate, truncate or with small teeth; corolla campanulate, tubular at the base, curved, leathery, white or yellowish; stamens included; disk large; ovary warty, with many seeds in several rows: caps. broad, densely covered with prickly warts; the persistent septum with enlarged margin.—About 20 species in Cent. and S. Amer. From the allied genera *Bignonia* and *Anemopaegma* it is easily distinguished by the prickly caps. and the ovary with the seeds in several rows. Adapted for cult. in subtropical and tropical countries only. For cult. and prop. see *Bignonia*.

cynanchoides, DC. (*P. clematideum*, Griseb. *Anemopaegma clematideum*, Griseb. *Bignonia alba*, Hort., not Auth.). Branchlets slightly hairy at first: lfts. ovate, long-acuminate and obtusely pointed, subcordate or broadly cuneate at the base, glabrous above, 1–2 in. long; petiole pubescent at the apex: fls. in terminal few-fld. racemes; the lowest pair of fls. long-stalked; corolla white, tubular-funnelform with spreading limb, pubescent outside, 1¼–2 in. long; ovary tomentose: fr. 2½ in. long, covered with yellowish spines. Nearly all the year. Argentina, Uruguay. Hieronymus, Icon. Descr. Plant. Argentina, 7. B.M. 8556.

muricatum, DC. (*Bignonia echinata*, Jacq.). Glabrous: lfts. ovate, acute or acuminate, rounded or subcordate at the base: fls. in terminal many-fld. racemes; corolla about 1 in. long, white, with yellow throat: fr. oblong, 2–5 in. long, densely covered with prickles. Mex.

P. buccinatorium, Mairet.—*Phedranthus buccinatorius*.—*P. cinereum*, DC.—*Distictis cinerea*.

ALFRED REHDER.

PITHECOLOBIUM (Greek, *monkey*, and *ear-ring*). *Leguminosae*. Tropical shrubs or trees planted for ornament and shade.

With or without axillary stipular spines: lvs. bipinnate; lfts. at first small, many pinnate or large, 1–3-pinnate, rarely with 1 lf.; petiolar glands rarely wanting; stipules small and inconspicuous or persistent, hardened or spiny: fls. 5- or rarely 6-merous, hermaphrodite or rarely polygamous, in head-like spikes; calyx campanulate or tubular, short-toothed; corolla tubular or funnelform; stamens few or many, much exerted, at the base or above united into a tube; anthers small; ovary sessile or stipitate, many-ovuled, style filiform, stigma terminal, small or capitate: pod compressed or flattened, circinate, twisted falcate, or rarely nearly straight, coriaceous, thick or somewhat fleshy, 2-valved, not septate between the seeds; seed

pulpy, short, often dark-colored, ovate or orbicular, compressed; funiculus filiform or with variously expanded fleshy arils.—About 125 species. The subgenus *Samanea* of Benthams is of generic rank. See *Samanea*, Vol. VI. It is distinguished from *Pithecolobium* by its straight indehiscent septate pods, and from *Enterolobium* by its straight, more or less constricted instead of short thick circinate or reniform pods.

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A. *Stipules mostly spiny: lvs. 1- or rarely irregularly 2-pinnate; lfts. 1- or few-pinnate: pod spirally twisted; seed with funiculus dilated at apex into a fleshy aril. (Unguis-cati.)*

B. Heads with short peduncles.

1. *dulce*, Benth. (*Mimosa dulcis*, Roxbg. *Inga dulcis*, Willd.). GUAYMOCHIL, HUAMUCHIL, or MANILLA TAMARIND. Large stately trees: lvs. and lfts. 1-pinnate; lfts. obovate or oblong, obtuse, very oblique, about 1 in. long: heads short-peduncled, the upper paniculate-racemose; fls. white, finely pubescent; calyx 1 line, corolla $1\frac{1}{2}$ lines long, white: pod twisted, 5-6 in. long, $\frac{1}{2}$ - $\frac{1}{2}$ in. broad. Mex., Philippines. Blanco Fl. Filip. 237. Beddome, Fl. Sylv. 188.—Widely cult. in the tropics as an ornamental. The pulpy aril of the seed is eaten by the poorer classes as food. The bark yields a yellow dye. It is said not to have fruiting in S. Calif.

BB. Heads with long slender peduncles.

C. Lfts. leathery: ovary pubescent.

2. *guadalupense*, Chapm. (*Inga guadalupensis*, Desv.). An unarmed shrub, 3-7 ft. high: lfts. 4, obliquely obovate, $\frac{3}{4}$ - $1\frac{1}{2}$ in. long, leathery, mucronate, undulate, delicately nerved, shining above; petioles shorter than the petiolules: heads yellow; peduncles solitary on the axils, $1\frac{1}{4}$ -3 in. long, exceeding the subtending bracts; calyx campanulate, pubescent, triangular lobes shorter than the tube; corolla pubescent, stamens 3-4 times longer than the corolla: pods 2-4 in. long, contorted. Fla. and W. Indies.

CC. Lfts. membranous: ovary glabrous.

3. *Unguis-cati*, Benth. (*Mimosa Unguis-cati*, Linn.). CATS-CLAW. BLACK BEAD. BREAD-AND-CHEESES. UNA DE GATO. An armed or unarmed shrub or small tree, sometimes 25 ft. high: lfts. 4, rather thin, obliquely obovate, oval, rounded or mucronate at the apex, finely reticulated; petioles slender, mostly larger than the petiolules: heads in terminal axillary panicles; calyx turbinate-campanulate, glabrous; corolla glabrous or nearly so; stamens twice as long as the corolla: pods 3-4 $\frac{1}{2}$ in. long, contorted. Fla., W. Indies, and Trop. Amer. Jacq. Hort. Schoenbr. 3:392. Vahl, Eclog. 3:25.—The bark is astringent, fr. edible, and the seeds medicinal.

AA. *Stipules inconspicuous: spineless: lvs. 1- to several-pinnate; lfts. 1- to several-pinnate, large or many-pinnate and small: heads small, paniculate: pod spirally twisted; seed without apex of funiculus dilated. (Clypearia.)*

B. Fls. mostly few, sessile, in heads.

4. *scutiferum*, Benth. (*Mimosa scutifera*, Blanco. *P. lobatum*, Benth.). A small tree: lvs. glabrous, 1-2-pinnate; lfts. 2-3-pinnate, ovate or oblong, acuminate, 3-6 in. long: fls. in heads, few (often 2-3) sessile, glabrous, or puberulent; calyx $\frac{1}{2}$ -1 line long; corolla up to 2 lines long: pod twice or irregularly twisted, often nearly a foot long, 1-2 in. diam., often much constricted between seeds: seeds large, compressed, orbicular. Trop. Asia, Java, Borneo, Philippines.

BB. Fls. many, in heads, distinctly pedicelled.

C. Branches terete: lvs. large, few-pinnate.

5. *pruinosum*, Benth. (*Albizia pruinosa*, F. Muell.). A slender tree, brownish puberulent or glabrous: lvs. 1-2-pinnate; upper lfts. 3-4-pinnate, broadly ovate or subrhombic, largest acuminate, 2-3 in. long: fls. in heads in the upper axils or in short corymbose terminal panicles, pedicellate, glabrous; calyx $\frac{1}{2}$ line long; corolla 2 lines long: pod spirally twisted or long-contorted, glabrous, deeply constricted, about $\frac{5}{8}$ in. broad. E. Austral.—Intro. in 1901.

CC. Branches angular: lvs. several- to many-pinnate.

6. *angulatum*, Benth. (*Inga angulata*, Graham. *Mimosa heterophylla*, Roxbg.). An ornamental small tree: branches and petioles at first brownish, puberulent, becoming glabrous: lvs. 2-4-pinnate; upper lfts. 4-8-pinnate, oblique, ovate-oblong, acuminate, 3-5 in. long, lower shorter, ovate-rhombic: panicle terminal; fls. few, in heads, pedicellate, tomentulose; calyx less than a line long; corolla about 3 lines long: pod circular or elongated, contorted, about $\frac{1}{2}$ - $\frac{3}{8}$ in. broad. Trop. Asia, Borneo, Philippines.

AAA. *Stipules present: shrubs (or rarely trees): lvs. 1- to several-pinnate; lfts. small or rarely 1 in. long. (Ortholobium.)*

B. Spines straight.

C. Lvs. 2-6-pinnate.

D. Lfts. 5-10-pinnate.

7. *mexicanum*, Rose. CHINO. A small tree, 15-20 ft. high, 1 ft. diam.: lvs. with straight stipular spines (sometimes wanting) 1 line long, 2-5-pinnate; lfts. 5-10-pinnate, oblong, 2-4 lines long, midrib a little excentric, puberulent, as are also the rachis and branches: infl. paniculate; fls. in heads, pedicellate; pedicels 1-2 lines long; calyx $\frac{1}{2}$ line long; corolla $1\frac{1}{2}$ lines long; petals spreading or reflexed; stamens long, numerous: pods oblong, somewhat constricted, 3-4 in. long, 1 in. broad, straight, its valves not elastic nor revolute; seeds 2, oval, 2-4 lines long. Mex.—It has the habit of mesquit and is valued for its wood. Rare, and rapidly becoming exterminated.

DD. Lfts. 3-6-pinnate.

8. *flexicaule*, Coult. (*P. texense*, Coult. *Acacia fericaulis*, Benth.). EBONY. A shrub or small tree, 20-30 ft. high: trunk 2-3 ft. diam., branching 8-10 ft. from ground, with short stout stipular spines: lvs. 4-6-pinnate, long-petiolate; petioles slender, puberulent; lfts. 3-6-pinnate, lower pair shortest, ovate-oblong, rounded at apex, glabrous, membranaceous or subcoriaceous, dark green, shining on the upper surface, paler below, $\frac{1}{4}$ - $\frac{1}{2}$ in. long on short broad petiolules: fls. in cylindrical dense or interrupted spikes, $1\frac{1}{2}$ in. long on stout pubescent peduncles, fasciated in axils of lvs. of preceding year, sessile, yellow or creamy, fragrant; stamens exserted: corolla 4-5 times longer than calyx, puberulent; ovary glabrous, sessile: pod flattened, turgid, straight or falcate, sessile, oblique at base, rounded and narrowed to a short point at apex, 4-6 in. long, 1-1 $\frac{1}{4}$ in. broad, dehiscent, thick, woody; seed imbedded in a thick pitchy pulp, suspended on a short straight funiculus, $\frac{1}{2}$ in. long, $\frac{1}{4}$ in. broad, irregularly obovate, bright reddish brown, sides faintly depressed. Texas to Low. Calif. S.S. 3:147.—The wood is heavy, hard, compact, close-grained, dark rich reddish brown tinged with purple, with clear bright yellow sapwood. Almost indestructible in contact with the ground and much used for fence-posts. The seeds are palatable and nutritious if boiled when green. They are roasted when ripe by the Mexicans who use the thick seed-coat as a substitute for coffee. A slow grower and not of sufficient size for timber.

cc. Lvs. 6-10-pinnate; lfts. 20-40-pinnate.

9. *brevifolium*, Benth. (*Acacia Neuciana*, Buckl.). HUAYILLO. An evergreen shrub or small tree up to 30 ft. tall, armed with short spines: lvs. 6-10-pinnate; lfts. 20-40-pinnate, oblong or narrowly oblong, $\frac{1}{8}$ - $\frac{1}{2}$ in. long, obtuse or acutish, reticulated beneath: panicles 2-4 in. long, peduncles $\frac{3}{8}$ - $\frac{1}{2}$ in. long: heads subglobose, $\frac{5}{8}$ - $\frac{3}{4}$ in. diam.; corolla 6-8 times longer than the calyx, lobes ovate, shorter than the tubes; stamens 2-3 times longer than the corolla: pods linear, oblong, flat, $2\frac{1}{2}$ -4 in. long, acuminate at apex, stipitate. Texas and Mex. S.S. 3:146.—The fls. are whitish and much sought by bees.

BB. *Spines recurved.*

10. *Sondrae*, Wats. UNA DE GATO. A shrub or small tree 15-20 ft. high, armed with short recurved stipular spines: foliage, infl. and branches canescent with very short spreading pubescence: lvs. 1-pinnate on a short (1-2-line) or very short rachis; lfts. 10-15-pinnate, oblong-elliptic, about a line long: peduncles mostly solitary (1-3) in the axils, 6 lines long or less; heads loose; fls. white, finely pubescent, nearly 2 lines long: pod rather thin, short-stipitate, flat, straight, dehiscent, puberulent, 2-4 in. long and $\frac{1}{2}$ - $\frac{3}{4}$ in. wide, 3-6-seeded. Mex.—Wood very hard and takes a fine polish. A good hedge plant for the Southwest if trimmed. A decoction of the branches is used for scours in horses.

AAAA. *Stipular spines absent: lvs. 1- or rarely 2- or more-pinnate; lfts. 1- to several-pinnate, large: fls. usually short, in heads or spikes at nodes of leafless branches: pod stiff, leathery.* (Caulanthon.)

11. *latifolium*, Benth. (*Mimosa latifolia*, Linn. *Inga latifolia*, Willd. *Calliandra latifolia*, Griseb.). A small tree or tall shrub, entirely glabrous: stipules persistent, lanceolate-acuminate: lvs. 1-pinnate; lfts. often 2-pinnate, ovate or ovate-oblong, acuminate, 3-6 in. long: fls. in loose nearly sessile or short-peduncled heads; calyx very small; corolla about $\frac{1}{4}$ in. long: pod curved, often a foot long and an inch broad. Brazil to Panama and in the W. Indies. Mart. Fl. Bras. 15, 2:119.

AAAAA. *Stipules fascicled: lvs. 2- to several-pinnate; lfts. 5- to many-pinnate, small: infl. in heads, axillary, peduncled; fls. sessile, short, glabrous: pod smooth, leathery or somewhat fleshy, straight or curved, scarcely dehiscent.* (Chloroleucon.)

12. *tortum*, Mart. A shrub or small tree, glabrous or pubescent: lvs. 2-5-pinnate; lfts. 5-9-pinnate, oblique, oblong, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: calyx less than a line long; corolla about $\frac{1}{4}$ in. long: pod curved or almost circular, about 6 in. long, $\frac{1}{2}$ - $\frac{2}{3}$ in. broad. Brazil. Mart. Fl. Bras. 15, 2:118.

P. dele, Vidal (*Mimosa acle*, Blanco)—*Albizzia acle*, Merrill.—*P. albicans*, Benth. (*Acacia albicans*, Kunth). Canescent-puberulent: lvs. 4-6-pinnate; lfts. 12-20-pinnate, oblique-linear-oblong, 3-4 in. long; infl. axillary; fls. glabrous; calyx $\frac{1}{2}$ line long; corolla 2 lines long: pod glabrous, 3-5 in. long, $\frac{1}{2}$ in. broad, coriaceous. Mex.—*P. filicifolium*, Benth. (*Mimosa filicifolia*, Lam.)—*Samanea filicifolia*, Ricker.—*P. fragrans*, Benth. (*Inga fragrans*, Macfad. *Acacia Berteriana*, DC.). Scabrous or minutely pubescent: lvs. 8-10-pinnate; lfts. 30-40-pinnate, oblong-linear or linear-falcate, 2-4 in. long, dark above, pale beneath, costa excentric: heads pedicellate in racemose panicles; calyx $\frac{1}{4}$ - $\frac{1}{2}$ line long; corolla $1\frac{1}{4}$ -2 lines long: pod straight, smooth, not much thickened, 3-4 in. long, 6 lines broad, indehiscent. W. Indies.—*P. geminatum*, Benth. (*Calliandra? geminata*, Benth.)—*Inga geminata*, Wight & Arn. An ornamental tree with large lfts. Ceylon. Hook. Ic. 16:1510.—*P. Saman*, Benth. (*Mimosa Saman*, Jacq. *Enterolobium Saman*, Prain)—*Samanea Saman*, Merrill.—*P. umbellatum*, Benth. (*Mimosa umbellata*, Vahl. *Acacia Concordiana*, Loud.). Puberulent: lvs. 1-2-pinnate; lfts. 4-10-pinnate, oblique-oblong, obtuse, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. in pedicellate heads, glabrous; calyx 1-1 $\frac{1}{2}$ lines long; corolla 3-3 $\frac{1}{2}$ lines long: pod curved, thick, 3-4 in. long, $\frac{1}{2}$ in. broad, constricted between the seeds. India.

P. L. RICKER.

PITTOSPORUM (Greek, *pitch seed*; in allusion to the resinous coating of the seeds). *Pittosporaceae*. Hardy or half-hardy evergreen woody plants grown especially in California and Florida. Several species are

excellent hedge plants, much preferred to privet and box in some localities; many are useful ornamentals for lawns and shrubberies; a few are used as avenue trees; nearly all have fragrant flowers.

Shrubs and trees: lvs. simple, exstipulate, alternate or apparently whorled: fls. regular, the parts in 5's; sepals distinct or connate at base; petals distinct or lightly united, tips often recurved; ovary incompletely 2-celled (rarely 3-5-celled); style 1; stigma 1: fr. a globose, ovate or obovate caps., 2- to many-seeded; valves leathery or woody.—About 100 species, chiefly of the southern hemisphere and largely Australian.

Pittosporums are usually propagated by seeds, which are sown in winter or early spring in ordinary soil in the cool greenhouse. Seeds do not keep well and those of the rarer kinds are difficult to procure; but all species are readily propagated from cuttings of half-ripened wood. *P. Tobira*, which seldom sets seeds, and its variety, which does not come true, are also obtained in this manner. *P. phylliraeoides* is best if grafted upon *P. undulatum*, since otherwise it is liable to be crooked and branched. *P. eriocarpum* is also grafted upon this stock. Seedlings should be reported from the seed-bed as soon as the second or third leaf has formed.



2988. *Pittosporum Tobira* var. *variegatum*. (X $\frac{2}{3}$)

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Tobira, 3.
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A. Fls. chocolate to black: seeds black.

1. *crassifolium*, Soland. KARO. Tall shrub or small tree, 15-30 ft.: young parts densely clothed with white or buff downy pubescence: lvs. 2-3 in. long, narrow-obovate or oblong, obtuse, narrowed to a short petiole, very leathery, dark green above, downy beneath, the margins revolute: fls. $\frac{1}{2}$ in. long, in terminal clusters: fr. $\frac{3}{4}$ -1 $\frac{1}{4}$ in. long, short-hairy, with 3 or 4 thick woody valves; seeds ripen in about five months. New Zeal. G.C. III. 30:431. Kirk, For. Fl. N. Z. 14. F.S. 21:2151. B.M. 5978.—Suitable for windbreaks and shelter near the sea; said to resist gales and salt spray; too coarse and rigid for ordinary yard planting. Wood white and tough; used for inlaid work; difficult of combustion.

2. *tenuifolium*, Gaertn. (*P. nigricans*, Hort.). TAW-HIWHI. Shrub or small tree, 20-40 ft., of symmetrical and compact growth: lvs. 1-3 in. long, oblong or somewhat obovate, mostly acute, thin, dark green, glabrous and lustrous when mature, the margins undulate: fls. $\frac{1}{4}$ - $\frac{1}{2}$ in. long, solitary in the lf.-axils, rarely fascicled; ovary silky: fr. $\frac{1}{2}$ in. thick, globose,

3-valved, glabrous and minutely roughened when mature. New Zeal. Kirk, For. Fl. N. Z. 46.—One of the best for clipped hedges, for mass planting, and for screening off undesirable views. Occasional pruning is necessary if a dense foliage is desired. Both this and No. 1 have yellow-flid. forms but these are not in the trade.

AA. Fls. white, greenish, or yellow.

B. Lvs. very obtuse, thick and leathery, but less so in *P. erioloma*.

3. *Tobira*, Ait. TOBIRA. JAPANESE PITTOSPORUM. Winter-flowering shrub, 6–10 ft.: lvs. 2–3½ in. long, 1–1½ in. wide, obovate, very obtuse, narrowed to the short petiole, thick and leathery, perfectly glabrous, margins revolute: fls. white or yellowish, fragrant, ¾ in. long, in terminal umbels: fr. ½ in. long, ovoid, angled, densely short-hairy. China and Japan. B.M. 1396. Var. *variegatum*, Hort. (Fig. 2988), has lvs. (often thinner) variegated with white.—In the E. this variety is the favorite pittosporum, as it makes a good house plant: both forms are cult. in Fla. and Calif. as lawn plants and for shrubberies: the deep green foliage and fragrant fls., the latter resembling orange blossoms, are very agreeable. Withstands violent saline winds better than most other shrubs, according to Franceschi.

4. *erioloma*, Moore & Muell. Tall shrub, 10–12 ft. or more, branching close to ground: lvs. 2–3 in. long, ½–1 in. wide, oblanceolate to obovate, obtuse, short-petioled, leathery but not so thick as in *P. Tobira*, deep green, paler beneath, glabrous at maturity, margins revolute: fls. yellowish, few in terminal umbels, ½ in. long, equaling the pubescent pedicels; sepals 1½ in. long, pubescent within: fr. globose, glabrous, ½–¾ in. across. Lord Howe's Isl.—Resembles *P. Tobira* and *P. viridiflorum* but is more desirable as an ornamental in that it is densely leafy to the ground and has handsome foliage.

5. *viridiflorum*, Sims (*P. sinense*, Desf.). CAPE PITTOSPORUM. Characters much as in *P. Tobira*, but becoming larger, to 25 ft., more tree-like: fls. smaller, greenish and yellow, in dense compound clusters: fr. subglobose, glabrous. Dec.–April. S. Afr. B.M. 1684.—One of the best of the larger pittosporums, scarcely known as yet; intro. by Franceschi.

BB. Lvs. acute, thin.

C. The fls. in terminal clusters: lvs. lanceolate or broader.

D. Young lvs. glabrous or nearly so.

E. Petals about ½ in. long.

6. *undulatum*, Vent. VICTORIAN BOX. MOCK ORANGE. Fig. 2989. Tree, to 40 ft. or more, but often pruned as a shrub: lvs. crowded on the branchlets, 3–5 in. long, 1–2 in. broad, oval-oblong to lanceolate, abruptly acute, deep green, coriaceous and shining, entire, undulate or flat: fls. white; sepals more than half as long as corolla, acuminate: fr. scarcely ½ in. long, nearly globose, smooth; seeds numerous, light brown. Jan.–July. Austral. B.R. 16.—Suitable for large broad hedges with dense foliage; when well spaced makes a large tree: used as an avenue tree in S. Calif., where it attains stately dimensions. Often selected for planting near summer-houses and dining-porches because of the rich odor of the bloom, resembling that of orange blossoms.

EE. Petals less than ¼ in. long.

7. *eugenioides*, A. Cunn. TARATA. Tall shrub or slender open tree with sparse and glossy light green foliage: lvs. 2–4 in. long, ¾–1¼ in. wide, elliptic-oblong, acute, undulate: fls. greenish yellow, numerous; sepals minute, acuminate: fr. slightly exceeding ½ in. long, ovoid, pointed at each end, ribbed, glabrous when mature. New Zeal. Kirk, For. Fl. N. Z. 49.—In Calif. the most extensively cult. species, much used for clipped hedges and ornamental shrubbery; hardy;

growth rapid; grows in pure limestone shale (Braunton); a variegated variety is cult. in Eu. Gn. 77, p. 277.

8. *rhombifolium*, A. Cunn. QUEENSLAND PITTOSPORUM. Pyramidal tree, to 80 ft.: lvs. 3–4 in. long, 1–2 in. wide, rhomboid, acuminate, coarsely toothed: fls. white, numerous, in terminal corymbs: fr. berry-like, ¼ in. long, nearly globose, becoming bright orange-yellow, glabrous; seeds 2–3, black. June–Sept. Austral. Hook. Icon. 621.—Sometimes grown as a pot-plant, more often as a tree for lawns and avenues. The bright berries persist through autumn and winter, making the tree very attractive.

DD. Young lvs. very pubescent, as also the fr.

9. *revolutum*, Ait. Tall shrub, rusty-pubescent on young parts: lvs. 2–3 in. long, 1–1½ in. wide, elliptic, glabrous above when mature, rusty-pubescent beneath, entire or undulate: fls. pale yellow, fully ½ in. long; sepals acuminate: fr. ½–¾ in. long; seeds numerous, red or brown. Feb.–April. Austral. B.R. 186.

10. *eriocarpum*, Royle. Widely spreading shrub or tree, 10–20 ft., the young parts white-tomentose: lvs.



2989. *Pittosporum undulatum*. (× ¼)

4–6 in. long, 1½–2½ in. wide, elliptic or oblong, narrowed to the ends, white-tomentose beneath: fls. yellow, ½ in. long, numerous in an oblong terminal raceme, fragrant: fr. ¾ in. long. Himalayas. B.M. 7473.—Grown in S. Calif.: very useful when a mass of light-colored foliage is desired: fls. notably banana-scented.

CC. The fls. axillary: lvs. linear.

11. *phillyræoides*, DC. NARROW-LEAVED PITTOSPORUM. Glabrous tree, to 20 ft. or more, with pendent twigs: lvs. 2–3½ in. long, about ¼ in. wide, entire; tips slender, recurved: fls. yellow, under ½ in. long, pedicelled in the lf.-axils: fr. about ½ in. long, oval, compressed, yellow, granular. Australian deserts. Maiden, For. Fl. N. S. W. 4.—Remarkable tree, resembling weeping willow but evergreen and suited to dry regions: root-suckers abundant.

P. bicolor, Hook. f. Shrub or tree with tomentose twigs: lvs. linear, glabrous above, tomentose beneath: fls. axillary, ½ in. long, yellow and purple. Austral.—*P. Buchanani*, Hook. f. Closely allied to *P. tenuifolium*: lvs. 2–5 in. long, oblong-lanceolate, acute, very thin, flat: fr. less than ½ in. thick. New Zeal.—*P. Colensoi*, Hook. f. Sometimes considered as a form of *P. tenuifolium*: branches stouter: lvs. 2–4 in. long, sharply pointed, flat, more coriaceous and deeper green. B.M. 8305. G.C. III. 26:370. Cult. in England.—*P. Fairchildii*, Cheesem. Shrub, related to *P. crassifolium*: lvs. broader, glabrous when mature, margins not revolute: fr. 9–12 lines long, glabrous when mature. New Zeal.—*P. floribundum*, Wright & Arn. A small tree: lvs. lanceolate or oblong-lanceolate, glabrous, shining: fls. in terminal compound corymbs, numerous, yellow. Subtrop. Himalayas, ascending to 5,000 ft.—*P. hawaii-*

ense, Hillebrand. Lvs. ample, acute, 7-10 in. long, 2-3 in. wide, sparsely to silvery hairy beneath; fls. in terminal clusters, cream-color. Hawaii.—*P. heterophyllum*, Franch. Half-reclining: lvs. medium-sized, ovate, acute, glabrous: fls. few, terminating short branchlets, light yellow. China. Offered by Franceschi for rockeries and embankments; drought-resistant.—*P. illicioides*, Makino. A handsome evergreen shrub: lvs. glossy green; fls. greenish yellow. Japan. In general appearance resembles *Illicium anisatum*.—*P. Kirkii*, Hook. f. Glabrous shrub: lvs. narrow-obovate, very thick, obtuse: fls. yellow, in terminal umbels. New Zeal.—*P. Rāphii*, Kirk. Shrub, related to *P. crassifolium* but fl.-margin not revolute: lvs. white-tomentose beneath: fr. 8 lines long, pubescent. New Zeal. G.C. III. 26:205 (as *P. crassifolium*).—*P. tetraspermum*, Wight & Arn. Shrub: lvs. ovate, acute, 2-4 in. long, glabrous: fls. terminal, yellowish: fr. glabrous, 4-seeded. India.

HARVEY MONROE HALL.

PITYROSPERMA: *Cimicifuga*.

PLACEA (possibly derived from a Chilean name). *Amoryllidaceæ*. Rare and beautiful Chilean bulbs, of difficult culture, bearing showy flowers something like an amaryllis (*Hippeastrum*), the colors being white or yellow, streaked with red.

Perianth funnel-shaped, with scarcely any tube; corona funnel-shaped, inserted at the base of the segms., deeply cut, the divisions notched, stamens inserted inside the corona; ovary top-shaped, 3-celled; ovules many, superposed; style declinate; stigma capitate, obscurely 3-lobed.—Five or six species. Botanically the peculiar feature of Placea is its cup or corona, which is smaller than that of *Narcissus*, and red instead of yellow or white. The beauty of the placeas, however, is of the *hippeastrum* type, though the fls. are not so symmetrical, for at first sight it looks as if two of the perianth-segms. were torn away. The peduncle is long and hollow.

Placeas are generally classed as autumn-flowering bulbs. Though natives of the Andes at considerable elevations, they are not hardy. The bulbs are said to lie deep in the ground in their native country, and pot culture is generally considered unsuitable for deep-lying bulbs. The bulbs go to rest about August and push up about December, flowering in May. In a pot they ought to have their time of rest, and must be buried in the soil, which ought to be very rich, but in pots they are not certain to flower. They must be planted with at least an inch of soil over their necks, and they prefer a loose soil.

ornata, Miers. Bulb 1 in. thick: lvs. 2, linear, appearing with the fls.: scape 6-9 in. high; umbel 4-6-fl'd.; perianth-segms. 1-1½ in. long. B.R. 27:50. Gn. 54:510.

P. grandiflora, Lem., is thrice as big as *P. ornata*, more floriferous, and is essentially distinguished by its perianth-segms., which are more acuminate and sharp-pointed. I.H. 15:574. F.S. 20:2047 (erroneously as *P. ornata*).

WILHELM MILLER.

PLAGIANTHUS (Greek, *oblique flower*). *Malvaceæ*. Trees or shrubs, rarely herbs, with large or small white 5-petaled flowers, little known in this country.

Bractlets none or distant from the calyx, which is 5-toothed or cut; column of stamens divided at the apex into many filaments; cells of ovary 2-5, rarely 1 or many; ovules solitary, pendulous: carpels in a single series: style-branches longitudinally stigmatose within: foliage and infl. various. Distinguished from *Abutilon* by the number of ovules.—About 12 species from Austral., New Zeal., and Van Dieman's Land. They are hardy in the most favored parts of England. None of the species is offered in America. They are known as "ribbon trees."

Lampenii, Boott. Botanically only a variety of *P. pulchellus*, but horticulturally very much superior. Shrub, attaining 6-8 ft.: lvs. oblong-lanceolate, 4-5 x ½-1 in., sharply serrate: fls. in short, axillary leafy panicles, very numerous and crowded; styles very small. Van Dieman's Land. G.C. II. 22:201.

pulchellus, Gray (*Abutilon pulchellum*, Sweet. *A. pulchrum*, Don). Tall shrub: lvs. lanceolate, cordate, acuminate, 2-3 in. long, coarsely crenate: fls. few,

clustered along rachis of axillary racemes; ovary 5-celled. Austral. B.M. 2753 (as *Sida pulchella*).

P. betulinus, A. Cunn. RIBBONWOOD. Tree, 30-60 ft. high, with trunk sometimes 3 ft. diam.: lvs. of mature plants 1-3 in. long, ovate or ovate-lanceolate, acuminate: fls. small, unisexual, in terminal or axillary decompound panicles, yellowish white. New Zeal. Said to be used by the Maoris for making rope and twine.—For *P. Lyallii*, Hook., see under *Gaya*, Vol. III, p. 1319, additional illustrations of which are G. 32:543; 35:677. G.M. 55:572. Gn. 44:28; 75, p. 372. G.C. III. 4:209; 41:332, 335. H.F. II. 13:361.

WILHELM MILLER.

PLAGIOBOTHRYS (Greek, *plagios*, sideways, and *bothros*, pit or hollow; wherefore the name should have been written *Plagiobothrus*). *Boraginaceæ*. Several species of low-growing commonly diffuse annuals from W. Amer., with small white fls. Here belongs *P. nothofulvum*, Gray, from Calif. to Wash., which was once advertised under its synonym *Eritrichium nothofulvum*, Gray. This plant has no horticultural standing.

PLAGIOGYRIA (Greek, *oblique* and *round*, alluding to the oblique ring around the sporangium). *Polypodiaceæ*. Warm-country ferns, formerly included as a section under *Lomaria*.

Sori inserted on the more or less thickened ends of the forked side-nerves, finally often confluent, usually covered by the revolute margin; indusium lacking; sporangia long-stalked with a complete oblique ring; spores tetrahedral: lvs. tufted, simple-pinnate, dimorphous; petiole fleshy-swollen at the base, the upper side of which has 3-6 spongy protuberances; sterile lvs. serrate; fertile lvs. smaller, mostly entire.—About 10 species, in tropics of New World, in the Philippines, Formosa, S. China.

costaricensis, Mett. (*Lomaria costaricensis*, Baker). A plant requiring warmhouse cult.: sterile lvs. 1 ft. and more long and about half as wide, with entire falcate lfts. which are less than ½ in. broad and united at their bases, thereby forming a winged rachis; fertile lvs. 1½ ft. long and 6 in. broad, with contracted lfts. Costa Rica.

PLAGIOSPERMUM: *Prinsepia*.

PLANERA (after J. J. Planer, 1743-1789, professor of medicine at Erfurt; author of several books on botany). *Urticaceæ*. WATER-ELM. Monotypic genus, allied to *Ulmus* and *Celtis*: lvs. pinnately veined, alternate: fls. polygamous, with deeply 4-5-lobed calyx; staminate fls. short-stalked, in clusters at the base of the young branchlets, with 4-5 stamens; pistillate or perfect ones on rather slender stalks, 1-3 in the axils of the lower lvs.: fr. a small muricate nut. The only species is *P. aquatica*, Gmel. (*Anonymus aquaticus*, Walt. *P. ulmifolia*, Michx.). Small tree, sometimes to 40 ft.: lvs. short-petioled, somewhat unequal at the base, ovate to ovate-oblong, unequally serrate, glabrous at length and somewhat leathery, 1½-2½ in. long: fr. oval, ½ in. long, with irregularly crested fleshy ribs. April, May. S. Ill. and Ky. to Fla. and Texas. S.S. 7:316. R.H. 1903, p. 351. This tree is not in general cult. and has little to recommend it as an ornamental plant. It would not prove hardy N. It probably thrives best in moist soil and is prop. by seeds sown soon after ripening in May and by layers, also by grafting on elm. The plants sometimes cult. under the name of *P. aquatica* belong either to *Ulmus campestris* var. *viminalis*, *U. parvifolia*, or *U. alata*, to which the true *Planera* is similar in foliage, or to some other small-ld. elm.

P. acuminata, Lindl.—*Zelkova serrata*.—*P. carpinifolia*, Wats.—*Zelkova ulmoides*.—*P. crenata*—*Zelkova ulmoides*.—*P. Kedkii*, C. Koch—*Zelkova serrata*.—*P. repens*, Hort.—*Ulmus pumila* or *parvifolia*.—*P. Richardi*, Michx.—*Zelkova ulmoides*.

ALFRED REHDER.

PLANE-TREE: *Platanus*.

PLANER-TREE: *Planera*.

PLANT (Latin, *planta*). A plant is a living organism consisting of one or more cells, some of which, in most of the higher forms, contain a green substance—chlorophyll—by the aid of which they are able in the light to construct carbohydrate food-matters (as sugar, starch, and the like) from carbon dioxide and water. The cell protoplasm assimilates or uses these carbohydrates and is nourished by them, and from the elements they furnish it is able to make cellulose, the substance which walls it in and gives strength and solidity to the plant. Animals do not (as a rule, at least) have chlorophyll, and cannot construct carbohydrates from carbon dioxide and water, and the same is true of some plants, as explained below.

Green plants absorb carbon dioxide from the air, and in the process of carbohydrate formation they give off a certain quantity of oxygen. However, in the further chemical activities of their cells, oxygen is absorbed and carbon dioxide is given off. In the plants which are not green (as in animals, also) the first process is wanting, while the second takes place. These facts have given rise to the view that plants and animals are quite opposite in their physiological relations to the surrounding air. They should not be contrasted, however, in this way; it is more exact to say that green plants have two important nutritive functions, namely (1) carbon absorption and fixation (technically photosynthesis), and (2) assimilation of food matters. Respiration—the process in which oxygen is absorbed and carbon dioxide is given off—occurs in all plants and animals.

With this general definition of a plant before us we may say that while some lower plants are minute single cells, or rows of cells, and others are flat, expanded and often irregular growths, in all of which there is a marked simplicity of structure, in higher plants we find the plant-body composed of well-defined roots, stems, leaves, flowers, fruits, and seeds. The lower plants referred to perform all the functions necessary for their continued existence, and are not in any sense "imperfect plants," as the older botanists used to denominate them. The difference between lower and higher plants is that the functions of the former are performed by fewer organs, while in the latter there is an approach to one organ for every function. Still it is true that some organs even in the highest plants have more than one function: so that it may be said that plants are theoretically capable of considerably higher development than they have yet attained. Thus while the chief function of the root may be for the absorption of food-matter, it commonly has in addition a holdfast function, and may become an organ of storage also. So, also, while the chief function of the leaf is to supply green cells for carbohydrate making (photosynthesis), it may be used as a storage organ (as in cabbage leaves), or even for making the plant more conspicuous (ornamental), as in many euphorbias. Even the flower usually unites two functions (that of fertilization and of showiness), which in more highly specialized forms are separated, as in the wild snowball where the large marginal flowers are for show but are sterile, while the small inconspicuous central flowers are fertile.

One more thing must be included in our general conception of the plant. While it is true that plants are normally, and typically, green in color, there are many plants which have so changed their food habits that they are no longer green. Thus parasitic plants that secure carbohydrates from living organisms, having no need of chlorophyll, are not green, and the same is true of saprophytic plants (those that get their food from dead or decaying organisms), which are also destitute of a green color. This is the explanation of the fungi, lichens, bacteria, and some flowering plants (e.g., dodder, Indian pipe, beech drops, and the like). Such plants are more or less degenerated, and are physiologically like animals, but they still retain enough of the

typical plant structure so that one is rarely at a loss where to place them.

C. E. BESSEY.

PLANTAGO (the Latin name). *Plantaginaceæ*. A group of 200 or more species of annual and perennial herbs or subshrubs occurring in many parts of the world. It is a weedy genus, and only two or three species have any economic or commercial value worth mentioning.

They are generally known as plantains, although this name is also applied to certain bananas (see *Musa*), which are plants of widely different kind. *P. lanceolata*, Linn., or ribwort, is sometimes used in pasture mixtures abroad, because it affords more or less spring pasturage on dry and sterile soils. The seed is offered by American seedsmen for feeding birds, but not for sowing. In this country, however, it is one of the worst of lawn weeds, thriving in our hot dry soils when grass kills out. The best remedy for it is to secure a better stand of grass, and this is made possible by making the ground rich and so treating it that it will hold moisture. *P. Coronopus*, Linn., the buck's-horn plantain, native to Eu., Asia, and N. Afr., is sometimes eaten as a potherb (see p. 1411). It is a low perennial, with linear-lanceolate often pinnatifid lvs. It is not in the American trade. *P. cordata*, Lam., of the E. U. S., has been offered by dealers in native plants as a subject for colonizing in bogs and margins of ponds. It is perennial, with a stout rootstock, large cordate-orbicular shining lf.-blades, and a slender spike rising 1-2 ft. high and bearing small pinkish fls. with exserted style and stamens. *P. major*, Linn. (Fig. 2990), is a very common doorway weed. Var. *variegata*, Hort., a variegated lf.-form, is offered in England. *P. mazima*, Jacq., from Siberia, said to have white feathery spikes, has been intro. into England. There are about 20 native or naturalized species in N. Amer. *Plantago* is the typical genus of the *Plantaginaceæ*, a family that contains two other genera, bitypic and monotypic,—*Littorella* in Eu. and N. N. Amer., and *Bougueria* in the Andes of Peru and Chile.

L. H. B.

PLANTAIN: *Plantago* and *Musa*. *P. Lily:* *Hoda*. *Rattlesnake P.:* *Hieracium venosum*. *Wild P.:* *Heliconia Bihai*.

PLANT-BREEDING: *Breeding*, p. 545.

2990. Spike of *Plantago major*.—Common plantain. (Nat. size.)

PLANTING. This *Cyclopædia* considers two classes or kinds of horticultural work,—the growing of plants, and the identifying of plants. The latter purpose runs throughout every generic entry, throughout the alphabet. The instructions for growing are combined with these generic entries, and are also extended in many separate articles, under the popular names of the plants themselves, as Rose, Strawberry, Carnation, Lettuce, Mushroom, and many others; and they are also displayed in class articles, as Alpine Plants, Kitchen-Gardening, Annuals, Biennials, Perennials, Herbs, Orchids, Palms, Arboriculture, and many others.

At this point, another set of class articles is assembled, with the purpose to bring together such instruction as is commonly associated with what is known as "planting,"—with the use of plants in the open and particularly in relation to their uses as a part of a landscape development. In connection with this symposium, the reader will naturally give special attention to the assembly on

Herbs in Vol. III and on Landscape Gardening in Vol. IV. Inasmuch as trees are discussed under Arboriculture and herbaceous plants under Herbs, the present treatment is mostly of shrubs. (Figs. 3001-3005, 3011-12, are adapted from "Garden and Forest.")



2991. A street improvement, exhibiting good community feeling.

This symposium on planting has the following parts:

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The relation of planting to the fundamental design.

It is the business of the landscape architect to combine beauty and utility into a harmonious composition. The artistic aim in the practice of landscape architecture is to produce beautiful pictures. To achieve such pictures, the creative imagination must be controlled by familiarity with the accepted canons of design. Good design in landscape work must be based on the fundamental principles of art and the laws of nature. Fitness, proportion, variety, mystery or intricacy, unity, and harmony,—all these must be considered.

While it is the aim, in creating landscape gardens and parks, to produce natural effects, the best results are not necessarily secured by a mere imitation of nature as it happens to exist in a given locality. It is possible to modify nature to fit artificial conditions; and by changing the scale, by adding new features, or making different combinations, compositions may be produced which have all the charm of a natural scene, yet surpass nature in beauty and interest. Varied emotions are produced by different compositions. Sometimes the mood is gay, as in flower-gardens. Awe, wonder, and admiration are produced by the large natural features,—rocks, cliffs, cañons, waterfalls, the mountains,

and the sea. Mystery and intricacy are conceived by rambles through the dense woods and jungles. Rest, peace, tranquillity are suggested by certain woodland scenes, a sheltered lake, or a meadow with a meandering stream. The sense of deliberation, dignity, and maturity is produced by the stately arched trees of avenue or mall, and by groves of matured trees.

Many laymen and artists think of landscape architecture only as a decorative art; and to their minds planting is of value only in so far as the foliage hides some ugly foundation, softens hard lines or relieves bare spaces, screens some unsightly view or forms a setting for an architectural feature. Sculptors and architects especially are prone to think that the most charming natural parts of our public parks are suitable sites for memorials in stone and statues in marble and bronze. They reason that the spreading branches of the trees and the background of foliage will enhance the beauty of their work of art. Their thought is of their own creation and they fail to realize that by introducing an artificial object, no matter how beautiful it may be in itself, the harmony and beauty of the natural scene may be destroyed.

From the point of view of the landscape architect, planting is not merely a superficial decorative process. He considers the arrangement and disposition of the foliage-masses as well as the modeling of the earth's surfaces to be fundamental in landscape design. Necessary buildings, roads, paths, and other artificial features, must be provided for use and enjoyment; but the best design is the one that succeeds in effectively obscuring or subduing these necessary objects in the landscape and still provides fully the facilities required for use, shelter, and other enjoyments of the people.

While design is the main consideration in creating a landscape, nature, life, and time are necessary for the completion of the design and the full development of its beauty. The beauty of a landscape is dependent largely on the green living things, as trees, shrubs, grass; but the success of the picture is due more to the disposition and arrangement of the material than to the materials themselves. Therefore, it sometimes happens that a thorough knowledge of horticulture, especially when this knowledge is combined with great enthusiasm and, perhaps, with an added interest in botany, is a decided handicap to the success of the amateur designer. The horticultural features are over-emphasized at the expense of the composition. Many places and parks that were originally well designed have been robbed of their charm and beauty and landscape effects, because of the interest and enthusiasm on the part of gardeners, owners of estates, or park commissioners in horticultural things. In the conviction that they are embellishing the beauty of a glade, valley, lawn, or meadow, they proceed to cover these open spaces with rare specimens of trees and shrubs, thus



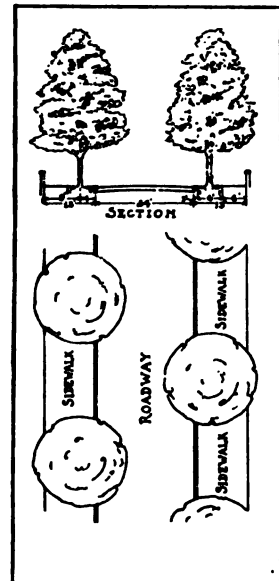
2992. A series of back-yard improvements, exhibiting pride in premises.

destroying the arrangement. Open areas should not be considered as waste space.

A landscape design may be either formal or natural. The character of the planting of formal gardens and terraces and the embellishment of buildings by planting should be in harmony with the type of architecture and with the nature

of the site of the garden and its relation to the house. In the design of a natural landscape, the three general classes of planting material—woods, shrubbery, and lawns or meadows—should intermingle to a certain extent, and yet be so arranged as to present in general an open central feature of lawn or meadow, with the masses of foliage surrounding. This provides unity, and the broad masses of light and shade produce a pleasing composition.

The outlines of the lawn or meadow should be irregular, and their limits somewhat obscured. Now and then trees or groups should be introduced, especially near the boundaries of the lawn, to add diversity and interest; the



2993. Planting plan for a business street in town.

shadows will relieve the monotonous expanse of light.

To design effective plantations, a knowledge of planting material, a conception of composition, and imagination and taste are requisite.

In planting, the landscape architect is more concerned with the color, texture, form, and size of flowers and foliage than with botanical families or with cultural requirements of plants; still, in order to design places and parks that will be in harmony with the general surroundings and to use material that will thrive, he must be familiar with the indigenous plant material, and know what soil conditions and locations are suitable for their peculiar needs. However, it must not be assumed that only those trees, shrubs, and plants that grow in the immediate vicinity may be used; but, in the creation of the natural landscape, the native plants and trees should predominate.

The most important planting material used by the landscape architect is "grass seed." Ordinarily grass is not considered in the general conception of planting, but most landscape architects and many laymen realize that grass in the form of lawns and meadows is the most significant feature of our naturalistic landscapes. Its value when used within formal lines, the tapis vert and terrace, are generally recognized. It is not far-fetched to say that grass is the most important planting material used in the creation of landscape in this climate.

Lawns and meadows provide color, texture, motion of the waving meadows, the play of light and the shadows of clouds and trees. The covering of grass over earth enhances the beauty of the contours and the modeling of the earth's surfaces—knolls, valleys, glades, and plains. The effects of space, breadth, dignity, and distant views are dependent upon the proper framing of open spaces with foliage. Indeed, open spaces, whether in the form of sea, lakes, or streams, lawns or meadows, sand-dunes or even paved spaces, are one of the most important elements in landscape design.

C. F. PILAT.

Village improvement in relation to planting.

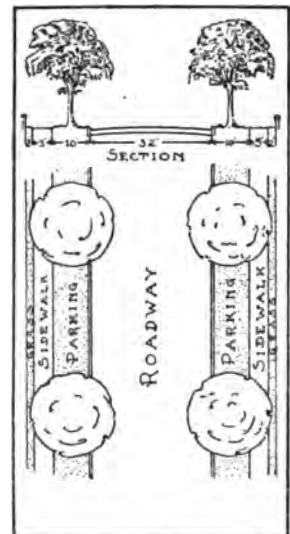
Village improvement is a branch of civic art. Civic art in turn may be defined as the conservation, improvement, and utilization of public property. Village improvement thus takes its place alongside of town-planning, country-planning, the development of garden cities, and other work of a similar nature. The public-property test may be rather strictly applied to all branches of civic improvement, including village improvement, for while village improvement does in fact undertake extensive work upon private grounds, this is undertaken solely in the public interest.

In village improvement it is rather important to fix attention upon the village or small town as a permanent unit. For the most part, the small towns of America have had notable ambitions for growth. Each one has intended to grow up into a state capital or a large manufacturing center. On this account it has been impracticable to make intelligent plans for the actual circumstances, that is for an indefinite period of existence without further expansion. The growth problem, while it is largely a psychological factor, is a very important one in connection with village life and development. It is a problem which should be seriously faced. Each community should understand its actual circumstances and its ambitions, if it is to make any real improvement in its condition.

Inasmuch as civic improvement is based upon public property, the scope of its work may be outlined rather strictly by the extent and character of property owned in any community. The more important types of public property, with some discussion of the problems attached to their improvement, are taken up herewith. The illustrations and plans (Figs. 2991-2996) suggest some of the important phases, particularly as related to planting.

Streets.—Streets and public roads constitute perhaps the most important mass of public property in each community. They are absolutely indispensable and have a very high monetary value judged by any scale whatever.

Road and street improvement is always looked upon as a practical benefit to the community and may, therefore, naturally and properly become the starting-point of general village improvement. Street improvement should be studied with reference to (a) location, (b) design, (c) construction, (d) furnishings, (e) maintenance. (a) The location of streets and roads is generally looked upon as an inviolable accomplishment, yet many roads and streets can be, and should be relocated, or altogether abandoned. In other places new streets should be provided. (b) Some streets ought to be straight, some ought to be curved, some ought to be wide, some should be narrow. Some should be provided with wide grass verges, with rows of trees and with parkings. In other parts of the village, streets should have no such furnishings. In fact, each street should be made a study by itself, and should be properly designed



2994. Plan for main residential village street.

2000



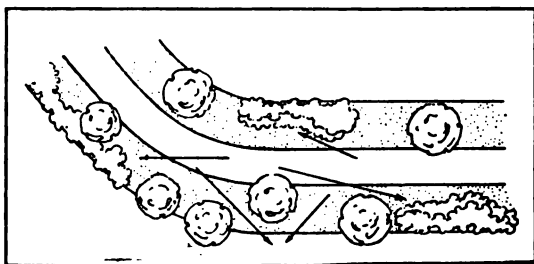
LXXXIX. Planting.—Rhododendrons in a landscape composition.

for its special conditions. (c) All streets, of course, should be well constructed. Macadam and tarvia are good materials. However, there are many streets which do not need such expensive improvement. The problems of street construction are generally fairly well studied, but of course, final and perfectly satisfactory results are never achieved. (d) Besides the trees in the street, there are many other things to be considered, such as guide-posts, letter-boxes, and especially telephone, electric-light, and trolley poles. All these furnishings should be made as satisfactory as possible. Especially in the matter of poles the ideal is to reduce their number to the minimum. (e) All streets need to be kept in good repair and to be kept clean. These are always important matters, but they cost considerably more care, labor, and money than most persons imagine. Village improvement can nearly always make considerable progress in this one point of keeping the streets clean and in good condition.

Transportation may be reckoned as the second great problem of village improvement. The development of attractive railroad station-grounds, by proper planting of trees, shrubs, and grass is a matter always to be looked after. In rural communities, at the present time, with the large development of trolley service, the design and location of first-class trolley waiting stations becomes a matter of great importance and should receive careful attention.

Schoolhouses and school-grounds constitute a very important type of public property, and every campaign of village improvement should look after them carefully. School-grounds should be kept clean and orderly and should have some tree plantings. Wherever possible there should be grass, but the improvement of school-grounds with flower-beds is almost out of the question. Perhaps the most insistent problem of the improvement of the school-grounds themselves, lies in securing adequate area, which should be from 2 to 5 acres for each school instead of the $\frac{1}{4}$ acre commonly allowed.

Playgrounds are very much needed in every village and rural community. The problems connected with them are, (1) to secure the necessary allotment of land; (2) to have this ground properly planned and developed, (3) to have the play properly supervised. The embellishment will consist chiefly of large trees for shade and to improve the appearance. Flower-beds and borders are quite out of place on playgrounds.



2995. Plan of country road, showing suggested arrangement of trees, shrubs, and flowers.

Reservations of several sorts are needed in every village. These should be primarily for recreation, but should include also places of historic importance or those of great scenic beauty.

Public buildings, including churches, libraries, grange halls, town halls, and the like, must be of the best character in order to secure proper results in village development. All these public buildings should be studied with reference to adaptation to use, proper location, grouping with other public buildings, good architectural design, and substantial construction. The grounds about these public buildings should be developed to the

best possible advantage. As a rule, shady lawns with good substantial trees give the best result.

Home-grounds are of prime significance in every community and every village-improvement society should undertake to secure the best treatment of them possible. Neighborhood competitions are useful to this end but sound horticultural instruction is always necessary.

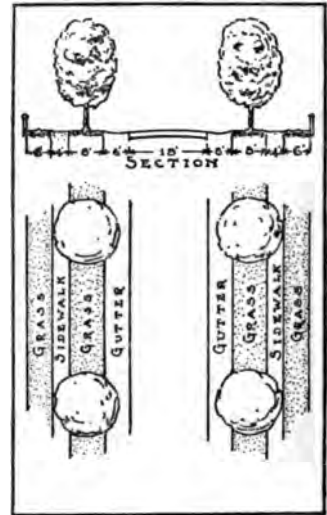
The more strictly horticultural phases of village improvement, therefore, are the planting and care of trees, the development of grass areas, especially lawns, home-garden improvement with some emphasis upon front yards, and school-garden enterprises of several sorts.

In the care of trees on public streets and grounds, a competent tree-warden is greatly to be desired. When state legislation provides for such an officer he should be chosen with great care and supported with reasonable appropriations of public funds; and in states where tree-wardens are not provided for by law such legislation should be secured as soon as possible. The Massachusetts law is perhaps as good a pattern as any.

Street trees are subject to severe injuries even beyond the liability of other shade trees, such as the damage from leaky electric wires and gas-pipes, gnawing of horses, and sometimes the attacks of ignorant linemen putting up wires. Add to these the usual menace of insect attacks, such as elm leaf-beetle, leopard moth, forest caterpillar, gipsy moth, and the like, and it will be seen that the protection of valuable street trees is a real undertaking. (See *Diseases and Insects and Arboriculture*.) The improvement of home-grounds and similar areas is treated elsewhere. (See *Landscape Gardening*.)

The peculiar agent of village improvement is the village-improvement society, but other organizations are equally useful. Woman's clubs and boards of trade are usually effective. Very often smaller groups which undertake to cover only a single street or a single small neighborhood accomplish the most intensive and satisfactory results. As a rule it is undesirable to form a new organization in any community for village improvement. It is better policy to seek the coöperation of the various existing societies. In certain circumstances these can be federated in a way to cover the problem satisfactorily.

Four factors must always coöperate in order to secure satisfactory results in civic improvement of any sort. These factors are (a) local initiative, (b) expert advice, (c) time, and (d) money. (a) It is always necessary to have some energetic local society or group of men and women who will stand behind any improvement proposition. Without this local initiative nothing can possibly be done. (b) In addition to this it is usually desirable and sometimes positively necessary to have work undertaken on the basis of practical plans drawn by experts from outside the community. The outside assistance is valuable even when no more expert than advice which might be secured within the community itself. Good



2996. Plan for country road four rods wide.

plans are, however, always indispensable. (c) It then requires a considerable amount of time to carry out important improvement projects. It has been estimated that from six to ten years are always necessary in order to bring a community around to a proper understanding of its problems, and to secure sufficient unity of opinion to accomplish valuable results. (d) Money is



2997. Planting without composition.

very important, but not one-half so important as persons usually suppose. As a rule the money can be raised whenever the community is convinced, as a whole, that the proposed improvement is worth while. It is best under all circumstances to have public property paid for and improved from public funds. This means that the money should be voted by the people themselves from the public treasury. The ordinary way of raising money for village improvement, by raffles, fairs, and other voluntary means, is wholly unsatisfactory. It can accomplish only trivial results.

FRANK A. WAUGH.

Shrubbery in the landscape.

Shrubs and bushes have two values: an intrinsic value as individual or single specimens; a value as part of the structure or design of an ornamented place. As individual specimens, they are grown for the beauty of the species itself; as parts of the landscape, they are usually grown in masses, constituting a shrubbery. It is often advisable to plant shrubs as single specimens, in order to produce the characteristic beauty of the species; but the temptation is to plant exclusively as isolated specimens, and the emphasis needs, therefore, to be placed on mass-planting.

Plants scattered over a lawn destroy all appearance of unity and purpose in the place (Fig. 2997). Every part of the place is equally accented. The area has no meaning or individuality. The plants are in the way. They spoil the lawn. The place is random. If the shrubs are sheared, the spotted and scattered effect is intensified. Rarely does a sheared shrub have any excuse for existence, unless as a part in an artistically designed formal garden.

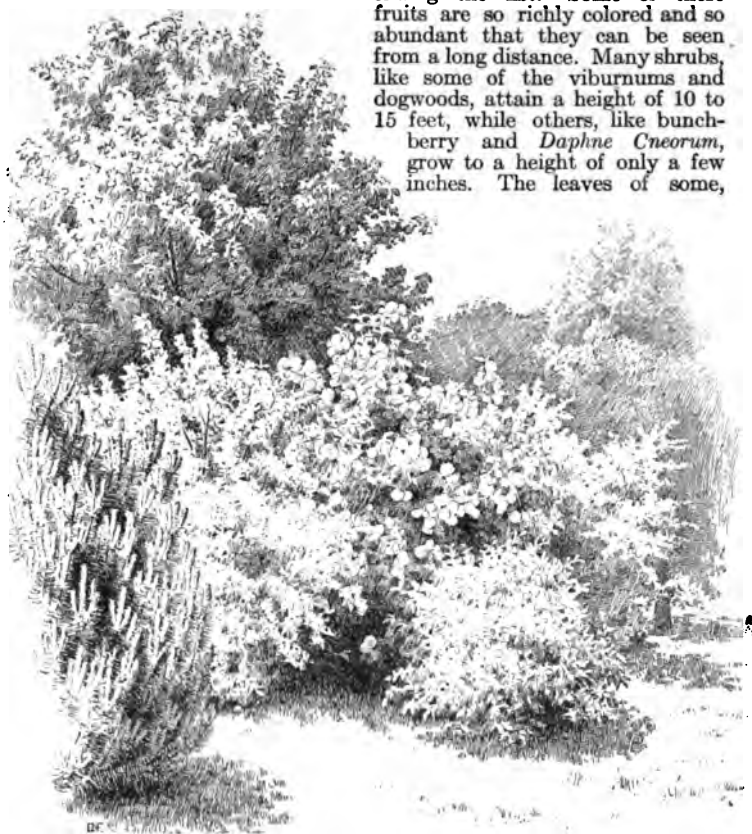
A mass or group of planting emphasizes particular parts of the place. It allows of bold and broad contrasts. It may give the place a feeling of strength and purposiveness. The shrubbery-mass usually should have an

irregular outline and it often contains more than one species. Thereby are variety and interest increased. Fig. 2998 suggests the interest in a good shrubbery-mass. The shrubbery-masses should be placed on the boundaries; for it is a concept of landscape gardening that the center of the place shall be open. (Fig. 2999; also Figs. 2076, 2077, and others in Vol. IV.) The boundaries are the lines between properties, the foundations of buildings, the borders along walks and drives. Judicious planting may relieve the angularity of foundations and round off the corners of the yard. (Fig. 3000.)

Individual specimens may be used freely, but only rarely should they be wholly isolated or scattered. They should be planted somewhere near the borders, that they may not interfere with the continuity of the place and that they may have background to set them off. The background may be a building, a bank, or a mass of foliage. In most places, the mass or border-planting should be the rule and the isolated specimen the exception; but, unfortunately, this rule is frequently reversed. It is not to be understood, however, that boundaries are always to be planted or that foundations are always to be covered.

L. H. B.

The chief value of shrubbery comes from its use in an artistic way, although some shrubs have edible fruits. Many shrubs, such as lilacs, some of the spireas, gooseberries, and currants, produce leaves very early in the season and some, like forsythia, daphne, and the junberry are covered with a profusion of blossoms at this time. From early spring until November in temperate latitudes leaves and flowers are to be found on deciduous shrubs, and from June until the following spring ornamental fruits can be seen on their branches, the red berries of the elder beginning and barberries ending the list. Some of these fruits are so richly colored and so abundant that they can be seen from a long distance. Many shrubs, like some of the viburnums and dogwoods, attain a height of 10 to 15 feet, while others, like bunchberry and *Daphne Cneorum*, grow to a height of only a few inches. The leaves of some,



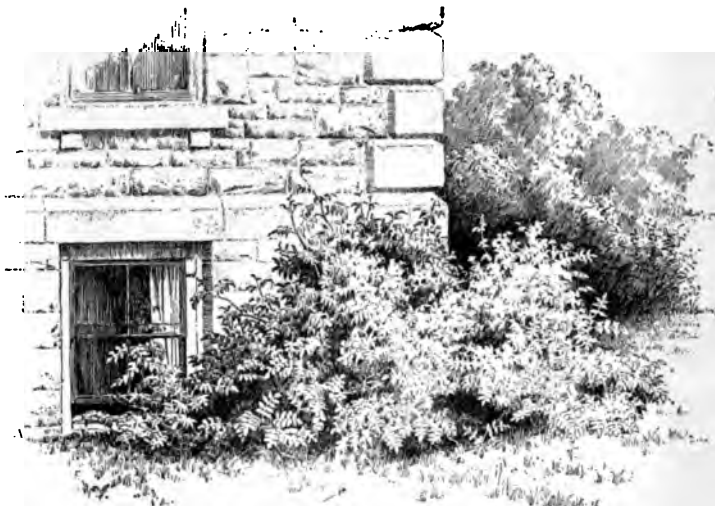
2998. A composition of shrub and tree forms.

like the chokeberry, Thunberg's barberry, the hazels, viburnums, dogwoods, and sumachs are beautifully colored in autumn. The rhododendrons, laurels, and mahonias, and the daphne already named, are examples of shrubs having evergreen foliage. Some leaves, like those of the *Salix lucida*, are glossy; others, as those of the common hazel, are hairy; some are thick, and others are thin; some large, some small; some entire, and some lobed, serrated or compound. Throughout the season the foliage of a good collection of shrubbery will present the greatest variety of color, including all the hundreds of shades of green as well as yellow, white, gray, and purple. Even in winter shrubbery is wonderfully attractive in appearance from the gracefulness of its stems and branches, and from the color of its bark. With the right selections, it will serve almost as well as evergreens to shut out from view fences or other low unsightly objects.

This great variety in foliage, flower, fruit, and habit of growth makes shrubbery adapted to very extended use in the development of landscapes. It is especially appropriate along the boundaries of ornamental grounds (Fig. 2999), upon steep slopes, and in the immediate vicinity of buildings where foliage and graceful lines are needed to connect the walls of a structure with the ground (Fig. 3000), without making too much shade. It might with advantage replace the grass upon all surfaces too steep to walk upon with comfort. The foliage of shrubs that are well established remains green when dry weather turns grass brown. The broad mass of shrubbery will take care of itself when the grass needs frequent attention. Even some level surfaces might be improved in places by exchanging a lawn covering for the covering of low woody plants. Often a broad open space over a lawn is an important feature of a landscape, since it allows extended views. Many times a landscape would be more interesting if the green underneath this open space were produced by a broad mass of shrubbery, like a miniature forest, instead of grass.

In planting borders or groups of shrubs, the ground to be occupied by such a group should be entirely spaded over or plowed. Perhaps no better advice could be given than to prepare the soil as it should be prepared for a field of corn. The bushes should then be planted so that there is room for about two years' growth before their branches intermingle. If placed closer they would have a crowded appearance from the start and would

not join their branches as harmoniously as when the new growth is allowed to choose its own position. If placed farther apart the effect is also bad. Occasionally a single shrub at the margin of a belt may stand out almost by itself, but generally the effect of a group should be that of a continuous mass of varying foliage.



3000. An effective planting against a hard corner.

In arranging different shrubs, the taller-growing kinds should generally be placed in the center of the group, and the lower species along the border, the space being graded from the highest to the lowest. The reason for this arrangement is that the lower plants would be killed by the shade of the larger ones if placed back of them, and moreover would not be seen; but one should avoid too uniform a slope. For example, in a continuous border there should be places where shrubs of larger size occupy the full width so as to bring growth of considerable height into the lawn. The arrangement should be varied so as to avoid all monotony, but in securing this variation a mixture of miscellaneous shrubs of all kinds does not give so good an effect as broader areas of single species or genera slightly interspersed at the margin with shrubs of another kind. Straight rows should be avoided. A laborer or a novice when told this will arrange the plants in a zigzag manner, thinking that he is placing them irregularly, the result often being almost the same as that of two rows. If the group is being planted along a straight line, as the boundary of a lot, the distances of the successive plants from this line might be somewhat as follows: 2 feet, 4 feet, 5 feet, 3 feet, 1 foot, and the distances apart, measured parallel with a fixed line, should vary also.

The ideal condition of a group of shrubbery is to have all the individual plants healthy, so that the foliage will appear fresh and of good color. This foliage should extend down to the surface of the adjacent lawn or walk, and shade the ground underneath so completely that nothing will grow there. The leaves which fall with the approach of winter should be allowed to remain as a perpetual mulch. The desired result cannot be secured the first year the shrubs are planted unless they are of large size and moved but a short distance. The aim in caring for a new plantation should be to secure thrifty plants, and this care, like the preparation of the soil, should be such as is given to a field of corn.

Very little trimming should be done. If a bush is tall and spindling it may be well to cut it off next to the ground and allow it to sprout again. If there is any dead wood it should, of course, be cut off. But when a shrub is healthy and vigorous, let it grow in its own



2999. The open center and margined sides.

graceful way. If it encroaches upon the walk, cut away the encroaching branch near the root so that the mark of the knife will not be noticed. Such treatment will help to retain the winter beauty of the branches.



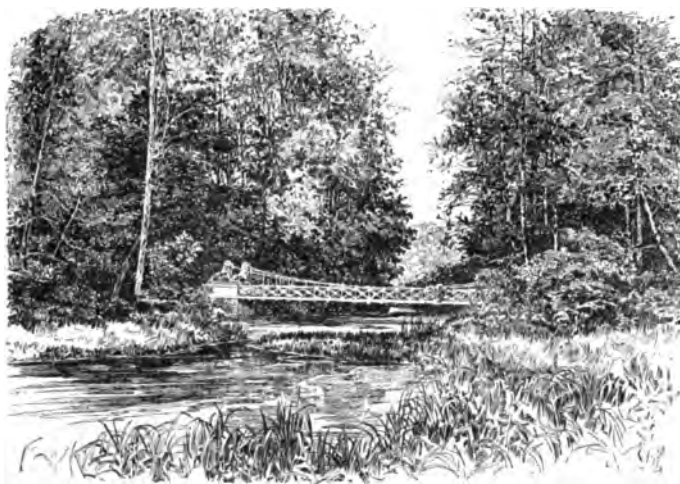
3001. A protection of shrub and tree forms.

verdurous landscapes that please him will have their furniture of shrub and bush.

O. C. SIMONDS.

Woods in the landscape.

The principal elements of landscape are atmospheric conditions, irregularities of the earth's surface, water, artificial constructions, herb and shrub ground-cover, and the woods. In the United States the great areas east, west, north, and south of the treeless prairie regions were mostly in evergreen or deciduous woods. Industries, habitation, and cultivation have divided the great wooded areas into small wood-lots and into forests that are for the most part broken into sprout- and tree-growth areas as the cordwood or timber is harvested in thirty- to sixty-year periods. The corresponding landscape modifications to that offered by this cutting of the forests is presented by homestead tree plantations that have broken the great unobstructed herb-covered prairie sweeps into series of tree-framed vistas. This offers a striking example of the importance of woods in landscape.



3002. A verdurous landscape of tree and shrub.—Thiergarten, Berlin.

In the arid regions of the West, the woods are confined to a meager growth in places made moist by springs, streams, or by irrigation, to mountain slopes and valleys, and to the humid regions and mountain valleys of the Northwest. In this last section, the region of sequoias, pines, spruces, and firs, are the state-liest cone-bearing forests of the continent. The white and Norway pines of the Northeast and the long-leaf pine of the Southeast, only approach the Pacific Coast Range trees in grandeur.

As landscapes of the highest types of beauty include woods, and as wood has a high economic value, one should determine how best to save woods for their beauty and to set aside the areas that should be harvested. To fix upon areas to be kept in woods and those to be used for agriculture, industries, and habitation, economic surveys should be made of large areas. In such surveys land that is ill fitted for cultivation should be outlined and set aside in public reservation, with a view to maintaining it largely in forests. Land that is suitable for cultivation, habitation, and industries should be set aside for these purposes, and the forests stripped therefrom as the land is needed. This countryside planning is already being worked out in the study of city and county. The plans of the regions about Boston, Massachusetts, in Essex County, New Jersey, and Cook County, Illinois, and of such towns as Hopedale, Massachusetts, represent studies in which forest areas are set aside, in public reservations, and the forest growth encouraged thereon.

It is not to be assumed that such forests are without other economic values than the recreation they offer to many persons. It has been found possible in the development of such areas to increase the beauty of the forests and to secure a money-return that will nearly, if not quite, cover the cost of the cutting from the sale of forest-thinning products. It is likely that under wise management such forests can be constantly increased in beauty with little or no burden of cost.

In the areas that are assigned in the economic study of a region for other purposes than permanent forest holdings, the existing forest growth may often be continued for many years as the principal crop, or new forests may even be planted and grown before the time comes to cultivate the land in annual crops.

In the development of woods in landscape, the work can be performed in such a way as greatly to increase the beauty of the existing growth, which now is seldom the primeval growth, by thinning to develop the finest specimens and the finest groups of trees. A selection can also be made in the cutting to increase the dominance of different species in different localities. Cutting may often be made to open vistas and wide views from particularly attractive viewpoints. It can also be made to develop more attractive sky-lines and foliage-masses as seen from valley viewpoints or from hilltop and ridges to distant hills and ridges.

The larger factors of beauty in landscape and the economic values of woods are of interest to the general public. To the individual owner of estates and home-grounds the woods have a more intimate and personal interest. Such owners are concerned about the protection against drifting snow, bleak wind, and hot sun, a shelter for the bird-life that protects the crops, a setting and a background for their home buildings to merge them into an agreeable landscape picture, a ramble and a picnic place where the wild flowers, the fruits, and the autumn leaves can be found by the children who love the woods. The wood-lot is also a place where many sticks of timber for special purposes and some

cordwood will be secured in the cutting from year to year of the weaker trees that are overtopped by their neighbors, and from thinning that must be made if the highest types of woodland beauty are to be developed. Bear in mind that the wood-lot in good soil may produce a cord of wood to the acre each year.



3003. A good open area, with attractive shrub forms and tree forms.

Fortunate is the owner who has an established wood-lot, and especially if he appreciates and takes wise advantage of its utility and beauty. As woods would be included the thicket of few trees in the little town lot as well as the acres of trees on the large estates, because in the cool shade and leaf-mold soil of each the same plants and bird-shelters may be established. When there is no wood-lot one must plant either evergreen or deciduous trees to make one. If the home lot is a small one and it is desired to have a little wood-lot high enough to walk under at once, at reasonable cost, tall slender collected or nursery-grown trees may be planted close together and then thinned as they grow.

If a shelter-belt for winter is the most important consideration, use such cone-bearing evergreens as the pines, spruces, hemlocks, junipers, arbor-vitæ, cypress, the last three for a narrow belt, or in the South and on the Pacific coast, such broad-leaved evergreens as the magnolia, eucalyptus, camphor tree.

It should be known that undergrowth and ground-cover plants with attractive flowers cannot be so easily established under evergreens as under deciduous trees; also that among the deciduous trees are more rapid-growing species with attractive flowers and fruit.

To grow a very interesting wood-lot in a few years from the small seedling plants that can be secured in large quantities at low cost, such plants would be set from 3 to 5 feet apart. At this distance they soon shade the ground so much with foliage as to kill out ordinary weeds and give encouragement to the more attractive woodland plants. Furthermore, close planting will force a rapid growth in height. In the selection of plants, about a third would be made up of the quick-growing low-cost species such as poplar, soft maple, negundo, catalpa, locust, and in warm sections the eucalyptus, pepper tree, grevillea. Another third would be made up of the slower-growing more permanent trees, such

as oak, maple, and magnolia. The last third would be of such undergrowth, shrubs, and small trees as the flowering dogwoods, red-bud, benzoin, viburnums, white fringe, rhododendrons, azaleas, callicarpa, manzanita, and madrona. Woodland ground-cover plants may be established by bringing them in from the woods with an abundance of the natural leaf-mold soil retained about their roots.

The location for the wood-lot is at the point near the home buildings where it will best serve such purposes as are referred to early in this article, but as open land in this position is very valuable for farm uses the lot should not be large; elsewhere on the farm the wood-lot should occupy land least suited for annual crops, such as the very steep slopes and the rocky or barren areas.

Aside from woods themselves, tree forms have their special values in providing structural features in a landscape, combining well with architectural forms and affording good backgrounds and boundaries. Strip the trees from such constructions as shown in Figs. 3004 and 3005 and note the effect.

WARREN H. MANNING.

Wild-gardening.

Wild-gardening is the art of arranging and growing colonies of hardy plants, native or foreign, so that they will look like wild flowers, multiplying with little or no care after planting. A wild-garden is not a garden that has run wild, reminding us of man's neglect; it is a poetic suggestion of the beauty of nature untouched by man. Beginners commonly suppose that wild-gardening is merely the cultivation of native flowers, as in a small border. Such an effort is worth while, but it is rarely artistic and can hardly be called wild-gardening. The main idea of the latter, originally, was to naturalize foreign flowers in larger masses than those of the garden. Wild-gardening is, therefore, a branch of landscape gardening which aims to reproduce the largest floral effects of nature with the least suggestion of man's interference.

The large facts in wild-gardening are: (1) the place or location for it; (2) the composition, as part of the landscape; (3) the kinds of plants; and (4) the small



3004. Tree forms in relation to informal architecture.—House in Japan.

or incidental effects of clumps and nooks here and there. Fig. 3006 shows a wild-garden composition; ordinarily, a wild-garden is supposed to be merely "wild" or growing at random, as in Fig. 3007, and this effect is sometimes much to be desired. The nook or corner effect of planting (4) is shown in Fig. 3008, representing a rear screen.

Wild-gardening as a distinct department of floriculture first came into popularity about 1870, when "The Wild Garden" was written by William Robinson. Robinson's first aim was to introduce more variety into English gardens, which were monotonously gaudy in the Victorian era. Because of their greater showiness, tropical bedding-plants had driven hardy perennial flowers out of fashion. Robinson put the border on an artistic plane by paying more attention to grouping, color schemes, and new varieties; he popularized the rock- and water-garden; and he created the wild-garden. His second aim in wild-gardening was to reproduce some of the loveliest floral pictures of the



3005. A background protection for an architectural construction.—
Temple entrance, Nikko, Japan.

North Temperate zone which demand freedom from the garden inclosure. A third aim was to make a place for thousands of plants worth growing that are banished from conventional gardens because they have small flowers, a short season, or are unsightly when out of bloom. A fourth aim was to satisfy the universal craving for wildness.

The areas most commonly used for wild-gardening are woods, meadows, and orchards. Unfortunately, orchards cannot usually be kept in grass for many years, as in Europe. Those who are the fortunate possessors of waterside, bluffs, rocks, or sandy wastes have special opportunities for wild-gardening. Those who are confined to city lots can merely suggest the spirit of wild-gardening in lawns and borders.

The finest effects in wild-gardening are suggested not by book-study but by nature-study, paying special attention to grouping and massing. For example, if the problem is to cover a bank, the books suggest locust, willows, or other suckering plants. The beginner then covers the bank exclusively with locusts or willows, which produces an artificial or gardenesque effect. Nature rarely adopts a one-plant solution of any problem. She generally grows three or four crops on the same ground, e. g., tree, shrub, and vine, or shrub, carpeting-plant, and bulb.

If one follows the nearest river-bank for a mile or so, the finest combination may be buckeye, wild gooseberry, and American bluebells, or sumach, blue phlox, and adder's-tongue. Such combinations always give more variety than one-plant solutions, generally more

color, and look wilder because they represent a mode of living worked out by ages of struggle. When one combines roses, lilacs, and peonies on a sand-hill, the plants look unhappy, especially in August, but if one plants red cedar and bayberry the plants soon look as if they had been there from time immemorial. The skill of the wild-gardener lies in detecting plant associations that will solve each practical problem and look as if they were hundreds of years old.

In massing plants so as to imitate nature the commonest notion is to scatter them indiscriminately, but this is no longer considered the surest and quickest way to produce the finest effects. The showiest floral effect in nature is the solid mass or sheet of flowers of a single kind. But this is not the finest or wildest effect. William Robinson often takes the clouds as patterns in outlining his colonies. Clouds also suggest good combinations of density and thinness in sowing seeds or planting bulbs. One of the finest floral effects in nature is the kind of massing known as "the mother country and her colonies." The object is to suggest that the flowers have sprung from seed scattered by the prevailing wind. The outlying masses, therefore, follow one general direction (without being in straight lines), and they decrease in number, size, and density as they recede from the largest mass.

Design in wild-gardening.

In the woods one generally has the greatest opportunity for intensifying the feeling of wildness, because it is often possible to shut out all suggestion of the outside world—including even the sounds of civilization. Therefore, woods are generally surrounded by an irregular belt of native shrubs dense enough to hide artificial objects from the interior of the wood, leaving openings only for the main trails. The entrances can be marked without making them too gardenesque by saving or planting any trees that naturally form a good arch or frame, as white pine often does, by planting some accent marks, such as red cedar, arbor-vitæ, canoe birch, and mountain-ash, or by training into a bower vines such as wild grape, clematis, bittersweet, or Virginia creeper. A system of trails is next established and the planting is usually made near the trails, from which the colonies are generally expected to spread gradually into the remoter parts of the wood. To secure the finest effects, however, it is necessary to plant the dramatic, or picturesque places, such as spring, brook, rocks, glades, hilltop, or outlook with the wild flowers appropriate to each situation. Wild-gardening in the woods is also known as landscape forestry.

In meadows it is possible to allow daffodil bulbs to multiply for many years, since they may not interfere with the hay crop. The foliage ripens and falls to the ground before harvest. Bulbs that bloom after harvest-time, like *Lilium superbum*, are best restricted to the edges of the meadow. But the sunny meadow generally offers the greatest canvas for painting floral pictures—daffodils by the 10,000 and narcissi either in sheets or colonies.

In fields, however, wild-gardening involves serious economic loss. Despite this fact, many efforts have been made to imitate the European grain-fields made glorious by *Papaver Rhæas*, the scarlet annual weed which is the parent of the Shirley poppies. The seed is cheap but the poppies bloom in a half-hearted fashion and vanish after a year or two.

In permanent pastures wild-gardening is limited to species that are not eaten by cattle, and the effects are necessarily scattering or spotty. On a hillside at Grave-tye, Robinson has naturalized the oriental poppy in isolated clumps of about a dozen plants. This is perhaps the most daring feat with which a wild-gardener may hope to succeed, for foreign flowers as gorgeous as this cannot pass themselves off as wild flowers. The

distant effect, however, is very spirited, and the green background saves the effort from vulgarity.

On rocks the arrangement is largely determined by the position of soil-pockets large enough to grow plants. Soil can be added, but at great expense.

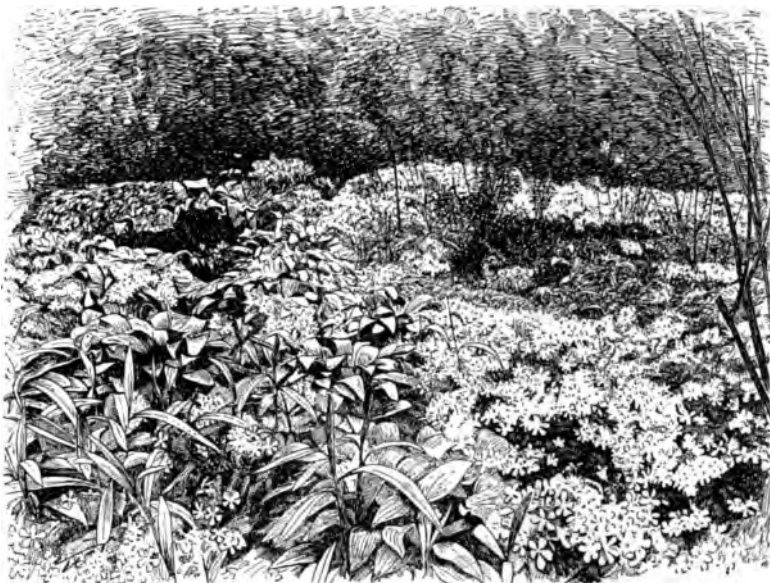
The waterside offers chances for unique effects, because the boldest tree-forms and colors have a mirror,

scilla, and glory-of-the-snow. Unfortunately, they cannot ripen their foliage before the lawn must be mown, and therefore they die in a few years.

Plant materials.

There are three principles that grow out of the aim of wild-gardening, which is to grow self-supporting colonies that will look and act like wild flowers. (1) The esthetic principle is that all materials in landscape wild-gardening shall be primitive species or slightly improved varieties. This rules out all flowers that have been profoundly modified by man, such as double and round-petaled flowers of all kinds. Double daffodils thrive permanently in some meadows, but they do not look like wild flowers, as single daffodils do. May tulips and Darwins are permanent, but these also do not look like wild flowers, as do tulips with pointed petals. Cottage tulips look wilder than other late tulips, and the wildest of all is *Tulipa sylvestris*. The magnificent red flower, *Tulipa Gesneriana*, which somewhat resembles the prototype of garden tulips, is too gorgeous to look like a wild flower in the woods, but it might be used for distant effects in the meadow, if oriental poppy is considered permissible. (2) The cultural principle demands permanence in wild-gardening. Crocuses, early tulips, and hyacinths are too short-lived in long grass. English books and magazines illustrate exquisite effects in March and April made by winter aconite, European cyclamen, Grecian wind-flower, and Apennine anemone, but these are too tender or difficult for the American public to naturalize. (3) The economic principle requires that the materials of wild-gardening shall be cheap, for expensive varieties are instantly recognizable and look out of place. A good rule is to pay not more than 1 or 2 cents a bulb for daffodils by the 1,000 or 500. There are twenty to thirty varieties that can be had at this rate, and they fit the woods and meadows better than the varieties that cost 3 or 4 cents a bulb.

Foreign species offer greater temptations for display than native kinds. The danger line is that between the garden and wild-garden. This has already been indicated for daffodils, which are the unquestioned favor-



3006. A wild-garden composition, showing the landscape effect.

shrubs may obscure the line where land and water meet, and amphibious plants, like the aquatic buttercup, may swim out a few feet. Also the grace of falling water can be suggested by shrubs with arching branches, or vines planted at the top of the bank. Some of the best colonies of wild flowers are those formed by seeds falling from the top of a bank.

In roadside planting, ideals have changed greatly since 1900. Then the standard of beauty was the shrub-lined roadsides of New England. That type is rapidly vanishing from the main roads, owing to the laws against the gipsy moth and the use of the stone walls for road-making. No two miles of roadside planting should be alike. There should be shrubs enough to bring back the birds; and wild flowers arranged and maintained according to the principles of wild-gardening.

On city lots, the wild-garden shrinks merely to a border of wild flowers but differs from the hardy border of mixed perennials. The latter is a conventional arrangement of flowers, mostly of foreign origin, selected for their showy forms, colors, and succession of bloom. The border of wild flowers may become an artistic wild-garden by directly imitating some natural effect, especially a local combination or plant association. For example, in the shady border the flood-plain may be recalled by hepatica, bloodroot, meadow rue, and trillium; the swamp by cinnamon and royal fern and marsh marigold; the ravine by *Aster laevis* and blue-stemmed goldenrod. In the sunny border the prairie may be recalled by cone-flowers, compass plant, and sunflowers; the swamp by boneset, joe-pye, and blue lobelia; the riverside by mist-flower (*Eupatorium caelestinum*) and sneezeweed; the dry roadside by butterfly weed and wild bergamot.

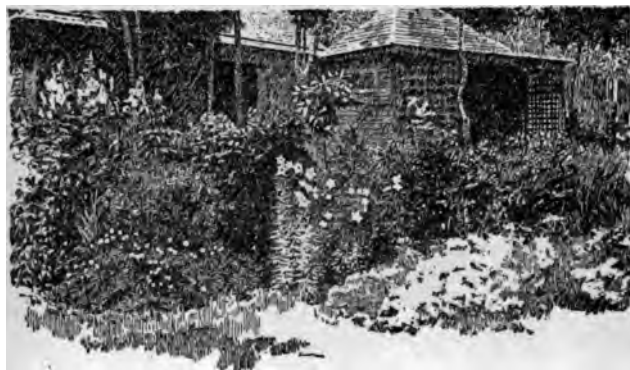
On city lots, also, the free meadow contracts into a close-cropped lawn, but the wild-gardening spirit is expressed in numberless attempts to naturalize crocuses and the March-blooming bulbs—snowdrop, Siberian



3007. A wild-garden.

ites for wild-gardening. Dutch hyacinths are inappropriate in long grass, and they soon perish. The Roman hyacinth looks more like a wild flower, but it is better to plant English bluebells or wood-hyacinths, known to the trade as *Scilla nutans* and *S. hispanica*, and the prairie hyacinth, *Camassia esculenta*. In addition to the foreign species commended, the lemon lily (*Hemerocallis*) is also adaptable, as its foliage harmonizes with long grass. This species looks much better beside the water than the orange day lily, which is better suited to the roadside. The most beautiful group for the water-side, probably, is the genus *Iris*. The famous iris meadow of the Royal Horticultural Society at Wisley, which has inspired much American wild-gardening since 1908, is a standard for combining the maximum of splendor with good taste. There is no difficulty in making the Siberian iris look wild, or the tall yellow iris of Europe, but the German and Japanese must be used with restraint, if at all.

It is safer to use large masses of native varieties than of foreign ones, but it is easy to overdo bee-balm, New England aster, butterfly weed, blue flag, and purple cone-flower, unless they are softened by shade, mellowed by distance, or veiled by long grass. Other American plants that are generally easy to manage on a large scale are marsh marigold, large-flowered trillium, wild



3008. A small wild-garden at the rear of a building.

blue phlox, spiderwort, *Lilium superbum*, boltonia, sneezeweed, sunflower, swamp rose mallow, and cardinal flower.

The ideal in the planting and after-care of a wild-garden is to betray no evidence of man's work. In planting bulbs, a good way is to scatter them on the ground, arranging them with the feet in cloud-like outlines containing about fifty bulbs, and then plant them where they lie, using a dibber or bulb-planter when the ground has been softened by the rains. Another method is to cut three sides of a sod with a spade, raise the grass, and insert five to seven bulbs at irregular distances. In the border the common unit of planting is a dozen plants; in the wild-garden fifty is a good unit. This is about the minimum that can be called a colony.

Wild-gardening was formerly considered essentially cosmopolitan in its spirit, as it still is in England. In America, however, wild-gardening commonly means the cultivation of American wild flowers, and the number of pure American compositions has greatly increased. Over \$6,000,000 worth of work done in the Middle West since 1901 has been inspired by the idea of restoration.

Gardening within an inclosure is a matter of personal privilege, but wild-gardening has developed a distinct code of ethics, due largely to the Wild Flower Preservation Society of America and walking clubs, like the Appalachian and Prairie, that do not permit their members to pick flowers, and a growing appreciation of wild life.

WILHELM MILLER.

Bog-gardening.

Bog-gardening depends for success on the distinction between bogs and other wet or swampy places (Vol. I, p. 519). In the marsh or swamp, drainage is usually fairly regular and free; in the true bog, drainage is practically lacking or free only during the spring thaw. Because of this lack of drainage there is in all bogs an accumulation of sourness in the bog-water, which is strongly acid and dark-colored in some glacial pot-holes, more moderately so in some of the partly drained bogs of the coastal plain regions of the country. There is usually, but not always, a deficiency of lime in bog-soils, and in nature there is a very large percentage of mycorrhizal plants in them. The relation of the mycorrhizal habit of obtaining food and the acidity of the bog is a very delicate and complex one and little is actually known of it; but experience has shown such a relation to exist.

The reason for having a bog-garden is that in it many very interesting plants may be grown that could not thrive in any other situation, and many ordinary swamp plants can also be grown along its edges. For those who have an undrained area or one poorly drained, the problem of having a bog-garden almost solves itself. But the demands of others who wish to grow the many beautiful species that will become naturalized only in such places, has led to the construction of artificial bogs. These may be of any size from a few square feet to comparatively large areas, and methods of construction must vary according to the nature of the subsoil. In places where there is a layer of hard-pan and the downward drainage is poor, it will be necessary only to dig out the desired amount, fill in enough blue clay to make the basin water-tight and then put in the mixture described below.

A more permanent and satisfactory type of construction is to make the basin of concrete, the walls and floor of which should not be less than 6 to 8 inches thick, to prevent the concrete from cracking during frost. Waterproof the concrete, and it is best to smear clay over the walls and bottom because in all concrete mixtures there is lime. The completed bog, whether of concrete or merely scooped out of the ground, should be 2 feet deep, its edges practically flush with the surrounding ground. If of concrete, sods will easily grow over it and the hard line of the rim may thus be completely hidden. One should be sure, before filling with the mixture, that the tank is water-tight, as though it were for a lily-pond. The shape of the structure, whichever type of construction is used, must be a matter of individual taste. While informality is the essence of bog-gardening, a "regular irregularity" is most to be fought against. Observation of natural bogs, their shapes and shorelines, will put the imaginative bog-gardener in possession of all the suggestions needed. As an important feature, it should be remembered that the drainage from the surrounding region should be all in, not out.

The mixture to go in the bog-garden is preferably one that has come out of a cranberry or natural bog,—muck, twigs, water, slime and all. From such a mixture, a host of very interesting bog-plants will spring up the first year and these may be isolated in clumps after the first season. A good plan when following this procedure is to let the inner part of the bog run wild, clearing a strip of a foot or two all around the edges for the cultivation of species needing, for exhibition purposes, more open spaces. Provision should be made, either in this strip or in any other open place in the bog for: (1) a place where only sand and peat soil, mixed about half and half, is found, to be used for certain plants that are described in the lists following; and (2) some small space of practically open water where the very interesting bladder-worts may be grown. The latter situa-

tion can be made by scooping out the muck for a few inches, filling in with sand and peat soil, leaving about 5 to 6 inches depth of water. For those who cannot secure muck from natural bogs, a soil may be mixed of leaf-mold, sand, and twigs and leaves of the oaks or of mountain laurel or rhododendron refuse. One should guard against getting the mixture too heavy and clayey. Sand and plenty of twigs and leaves of the species mentioned will lighten up the mixture,—leaf-mold makes it more heavy.

The management of the bog-garden requires some skill and observation. As the amount of evaporation from the surface is enormous, water must be added, either artificially or naturally. Strive to keep the bog just full enough not to overflow, thus keeping the whole sponge wet, but preventing the leaking out of the valuable acids that are the life of the bog. Both for the effect and for the good of the bog, it is desirable to cover all the open spaces in it with live sphagnum moss, which when once established, will make a delightful carpet.

Plants for the bog-garden.

Many bog-plants are very showy and worthy of cultivation. Others, such as the insectivorous kinds, are among the most wonderful plants in nature, for they have the unique distinction of being able to digest animal matter directly, a habit otherwise unknown in the realm of vegetable life. In the following account of bog-plants many are necessarily omitted, and it should be remembered that a number of purely swamp species, not mentioned here, can also be grown in bogs.

I. SHRUBS.

Rhodora (*Rhododendron canadense*), purple flowers before the leaves in April and May; 3 to 5 feet.

Swamp azalea (*Rhododendron viscosum*), white or pink flowers after the leaves in May or June; 5 to 8 feet. Sheep-laurel (*Kalmia angustifolia*), purplish pink flowers, summer; 1 to 2 feet; also *Kalmia polifolia* in northern regions.

Leather-leaf (*Chamaedaphne calyculata*), small whitish flowers along one side of the branches, May; 1 to 2 feet.

Labrador tea (*Ledum grælandicum*), white flowers in terminal clusters; leaves russet-brown below; 2 to 5 feet.

Wild rosemary (*Andromeda polifolia*), drooping white flowers, early spring; leaves silvery below; under 2½ feet.

Creeping snowberry (*Chiogenes hispida*), prostrate, with tiny white flowers and snow berries; leaves dark, evergreen.

There are many others, but these are the best for the temperate regions of the United States. In the South many others are to be found.

II. PERENNIALS, grown chiefly for their flowers.

In any open part of the bog.

Calla palustris, a greenish flowered water arum having a conspicuous white spathe; showy and hardy.

Acorus Calamus, sword-shaped leaves and a finger-like flower-cluster; the root is the medicinal calamus.

Viola lanceolata, a delicate, very free-flowered violet with lance-shaped leaves.

Asclepias lanceolata, a deep red milkweed, very showy, and with smooth narrow leaves.

Potentilla palustris, the purple marshlocks, a sprawling rather rank bog-plant with purple flowers.

Penthorum sedoides, greenish yellow flowers in curved spikes in summer; native plant, probably not in the trade.

Orontium aquaticum, the golden-club, very early flowering, making a patch of gold in March or April.

Menyanthes trifoliata, with three-divided leaves and many conspicuous white flowers; the buck-bean is a valuable addition.

Helonias bullata, flowering in April to May; the swamp pink is our most conspicuous spring flower.

There are many asters, goldenrods, and eupatoriums that grow in bogs, as well as some gentians, but the bog species must be collected from the wild.

In wet sandy places.

Here must be grown all the species of *Xyris* or yellow-eyed grass, curious plants with long, delicate, grass-like leaves and tiny heads of yellow flowers. Also species of *Eriocaulon* or bunch-flowers should be grown here. They are not large, have sword-shaped leaves and white erect heads not unlike the everlastings. With these two must go the meadow-beauty, different species of *Rhexia* with beautiful purplish red flowers. The common *R. virginica* is the hardiest and easiest to procure.

All the plants in this class and the following are to be secured from dealers in bog-plants or collected in the wild. There are others such as *Lophiola*, *Narthecium*, and *Zyadenus*.

In open water.

The bladder-worts are different species of *Utricularia*, some with purple and some with yellow flowers, some floating on the surface and supported by air-bladders, others rooting near the edges of the pool. They are the most interesting and delicate of all bog species.

III. BOG ORCHIDS.

Many native orchids can be grown only in bogs, and from them the following have been selected, as the most noteworthy. All are perennials and may be secured from the dealers.

Calopogon pulchellus, pink-purple flowers about an inch in diameter, June and July; leaves grass-like.

Cypripedium parviflorum, a small-flowered yellow lady's slipper; raise up so that the roots will not be too wet.

Cypripedium spectabile (*C. reginae* or *C. hirsutum*), showy lady's slipper; beautiful rose-purple or nearly white flowers; better for a little shade.

Habenaria blephariglotis, a white-fringed orchid with a showy spike; 1 to 2 feet; does splendidly in the open sun.

Habenaria ciliaris, yellow fringed orchid; very showy spike; 1 to 1½ feet.

Arethusa bulbosa, beautiful purplish pink flowers, about the last of May; 3 to 6 inches.

Spiranthes cernua, white, slender spikes; the ladies-tresses; several others, even more slender species are known.

Besides these are over forty other species which may be collected by the enthusiast. Nearly all of our most beautiful native orchids are bog-flowers. Most of them can be grown in pure live sphagnum moss.

IV. INSECTIVOROUS PLANTS.

Grown more for their peculiar habits of getting food and for their odd form than for beauty. They are of several types; some catch insects in a tube-shaped leaf, drowning them at the bottom of the cup, others have sticky hair to which the insect becomes fastened, and the most wonderful of all, the *dionæa*, actually traps its food by a contraction of its jaw-like, prickly leaves. The best insectivorous bog-plants are as follows:

With pitchers.

Sarracenia purpurea, having short purplish red pitchers, quite hardy northward, but not easy to maintain in an artificial bog.

Sarracenia rubra, the red trumpet-leaf, with tall pitchers; does very well in artificial bog.

Sarracenia flava, also with tall pitchers but yellow.

Sarracenia Drummondii, with variegated pitchers, the largest and most showy of all.

The last three must be taken in during the winter, north of Washington, D. C.; all of them grow rapidly and, if the season is favorable, will color up beautifully.

With sticky hairs.

All the species of *Drosera* have the curious habit of catching and digesting insects. They are all small plants which should be planted in masses on sphagnum moss. All native species are quite hardy and many can be secured from dealers in bog-plants. *D. rotundifolia* is the best; and *D. capensis* is a good species, but hardy only South.

With contracting leaves.

The Venus fly-trap, a low perennial with two valve-like leaves that contract whenever an insect or other irritation comes between them. Closing up rather rapidly these leaves are among the most interesting objects to see in the bog-garden. Not hardy north of Washington, D. C.

The darlingtonia, a Californian insectivorous plant allied to the eastern *sarracenia*, can be grown along the Atlantic coast only with protection, but south of Washington it should be hardy. One of the most striking bog-plants. See Vol. II, page 964. N. TAYLOR.

Water-gardening.

Water-gardening is the cultivation of water-lilies and the other aquatic plants, those that grow in water rather than in bogs or wet soil, particularly those that have floating parts.

Water-gardening is such a special form of plant-growing that it should be attempted only in the personal parts of the grounds, and where all the conditions of control can be secured. The species formerly known were mostly collected from tropical climates and were adapted almost exclusively for warm greenhouse culture and were to be found solely in botanic gardens and homes of the wealthy. However, the idea that our central Atlantic states were sufficiently warm to grow

some of the tropical varieties out-of-doors in summer was tested in the early eighties of last century by the successful flowering out-of-doors without artificial heat of a plant of *Victoria regia*.

For many years the aquatic gardens in Lincoln Park, Chicago, the Shaw Botanic Garden in St. Louis, Missouri, the New York Botanical Garden at the Bronx, and Prospect Park, Brooklyn, as well as in other cities, have paved the way for the advancement of this popular and most interesting phase of gardening.

But it was not until Latour-Marliac, of France, conceived the idea of crossing species of the hardy nymphaeas of the United States, notably the southern species *N. mexicana* (*N. flava*) and *N. tuberosa* (Fig. 3009, from G. F.), that a great impetus was aroused in the cultivation of water-lilies. The cost of maintaining a high temperature for the cultivation of the tropical lilies, besides the necessity of having a glass structure and water-tight tanks, cisterns, and so on, seemed still to impress the public generally that it was too costly to construct artificial pools and fountain basins. The products of Latour-Marliac found a ready market in England and as rapidly as he introduced a new hardy water-lily the more enthusiasm was aroused and the more the demand increased; and their popularity naturally spread to the United States. See also the discussion under *Nymphaea*.

It has been demonstrated that water-lilies can be grown successfully in the United States; not only the hardy varieties and the hybrids but the tender tropical nymphaeas, the victorias, the Egyptian and Japanese lotus are to be seen, during our summer season.

Many gardens and plantings of water-lilies and aquatic and subaquatic plants are too stiff and formal. Nothing is so inartistic as regular lines on the margins of some ponds and again of crowding too many varieties in one small pond. Natural planting is in masses and groups, and single plants are admissible only in small ponds or artificial basins in small and limited gardens.

Since it is found that reinforced concrete is the simplest means of construction and that water-tight and frost-proof receptacles can be secured at moderate expense, water-gardening is rapidly developing. Also the number of species has so rapidly increased that it is no longer difficult to select water-lilies for a miniature garden, tubs, small pools, fountain basins, ponds, and lakes; also for all seasons of the year, as it has been demonstrated that these charming flowers can be had in the depth of winter.

For the small garden where there is but a limited space, a miniature artificial stream terminating in a small pool could be constructed; on either side of this streamlet may be planted moisture-loving plants such as calamus, calthas, *Calla palustris*, rushes of various kinds, menyanthes, sagittarias, lobelias (cardinal flower), *Myosotis Scorpioides*, and iris in variety; and in the pool the miniature water-lily, *Nymphaea tetragona* (*N. pygmaea*) (white) and *Nymphaea tetragona helvola* (yellow). This style of water-garden can be carried out on a much larger scale where space will permit and a much larger collection of subaquatic and moisture-loving plants can be used as well as more nymphaeas and of larger dimensions.

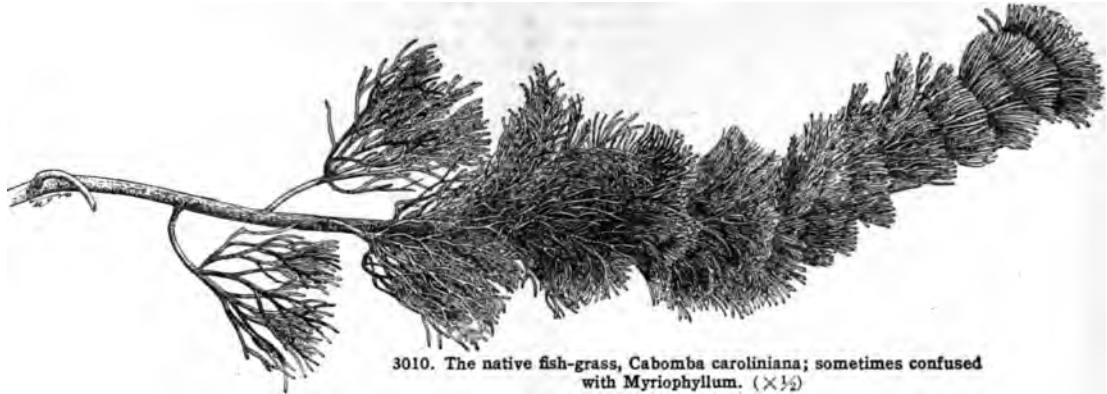
Water-gardening on a small scale can be most successfully carried out with the use of tubs, half-barrels sunken in the ground, two, three or more placed as thought best. In the rear of the tubs plant Japanese iris, flags, and moisture-loving plants, making a pleasing background, and between the tubs if ground can be kept moist, parrot's feather (*Myriophyllum proserpinacoides*), or *Myosotis scorpioides* (*M. palustris*), or *Lysimachia nummularia*, or dwarf trailing plants. For tub culture nymphaeas of moderate growth are preferable. *N. Laydekeri* var. *rosea* and *N. Laydekeri* var. *lilacea* are both charming varieties of pink rosy lilac, changing to rose and carmine, very free flowering. There



3009. *Nymphaea tuberosa*, a native water-lily readily grown in ponds. The rootstock is shown in Fig. 2555 in Vol. IV. ($\times \frac{1}{4}$)

are several other nymphæas of moderate growth and pleasing shades of color suitable for tub culture. Many persons make serious mistakes by selecting strong and vigorous plants suited only for large ponds or even lakes. The plants may live and be very thrifty but will not flower.

used in outdoor planting. The fibrous-rooted exotics, such as palms and tree ferns, are grown in greenhouses for the full year, either in permanent beds or in pots and tubs. The larger and more perfect the specimen, the greater its value. Usually in such a collection of plants under glass there are numerous species each



3010. The native fish-grass, *Cabomba caroliniana*; sometimes confused with *Myriophyllum*. ($\times \frac{1}{2}$)

A better and very satisfactory water-garden for a small place can be had by constructing a concrete pool 4 to 5 feet, or any size desired, bearing in mind that a large pool in a small garden is inconsistent. A pool or basin 4 to 5 feet in diameter and 2 feet deep will accommodate three nymphæas. The surroundings may be similar as recommended for tubs, but no two gardens are alike.

Other aquatics may be found under the genera *Alisma*, *Aponogeton* (*Ouvirandra*), *Azolla*, *Brasenia*, *Butomus*, *Cabomba* (Fig. 3010), *Ceratopteris*, *Eichhornia*, *Elisma*, *Elodea*, *Euryale*, *Hottonia*, *Hydrilla*, *Hydrocharis*, *Hydrocleis*, *Lemna*, *Limnobia*, *Limnocharis*, *Ludwigia*, *Myriophyllum*, *Nelumbo*, *Nuphar*, *Nymphoides* (*Limnanthemum*), *Pistia*, *Potamogeton*, *Riccia*, *Ricciocarpus*, *Sagittaria*, *Salvinia*, *Utricularia*, *Vallisneria*. See also the articles, *Aquarium*, *Aquatics*, *Nymphæa*, *Victoria*; also *Bog-gardening*, page 2666.

WILLIAM TRICKER.

Subtropical-gardening.

Under this denomination are included all those gardening efforts that aim to introduce into cool or cold climates the plant forms and the foliar luxuriance of tropical and semi-tropical regions. The subtropical garden may be permanent if it is under glass; but the term is usually employed to denote the summer effects secured by transferring glasshouse plants to the open and combining them in such a way as to produce a harmonious composition. It is not often that an approach to real tropical effects can be made in a northern garden, and yet it is well to have these effects in mind; Figs. 3011, 3012, reduced from *Garden and Forest*, show real tropical vegetation.

Subtropical plants are represented by the lush-leaved caladiums and cannas, the brilliant-colored foliage of crotons and dracenas, the towering plumes of palms, the succulent leaf or stem of century plant or cactus, and the dense rank ground-cover of selaginellas and todeas. The interest in such plants is chiefly in the foliage, rather than in the flowers. In the plant groups they stand at the opposite extreme from the rock-garden plants with tufts, cushions, and mats of miniature foliage that in the blossoming season are nearly covered with flowers, and thin films of mosses, lichens, and algae on the rock and earth surface.

The subtropical plants of each of the climatic regions of the United States are usually from a warmer region, although natives having a like character may well be

represented by one or a few plants, all grouped together in a crowded mass. Such a collection is not a subtropical garden and does not represent the most effective use of the material.

The potted plants that have foliage tough enough to withstand summer winds and sun, such as palms, cycas, ficus, and crotons, are often used in the garden in summer, or under the protection of trees, as subtropical beds or garden compartments. Each plant is valued for itself, just as it is in the greenhouse in winter, size and perfection of form being its chief attractions. Each has no relation to the foliage about it, except that its unusual character of leaf and growth makes a striking contrast to the normal native vegetation. For this kind of planting a few well-grown specimens give the desired summer appearance to the garden.

One of the very best of indoor subtropical gardens in America is the tropical house at Garfield Park, Chicago, where a comparatively few species, such as the tree-fern overhead and selaginellas as a ground-cover, are used in large numbers to make bands of foliage to arch paths and hide the glass roof, and to frame in vistas to glimpses of water, with carpets of green below. Here is a consistent and exquisite example of subtropical-gardening, the dominant note is light with the artificial construction that supports and protects it all, so cleverly disguised as to make it appear like a real glade in the



3011. A tropical planting.—Entrance to the botanic garden, Peradenia, Ceylon.

tropics. There is an effect of airy lightness to it all that is a thrilling surprise as one passes in from the snows of winter out-of-doors. Equally as distinctive and effective results would be secured by the use of such greenhouse vines as *tacsonia*, *allamanda* and *bougainvillea*, or by the use of the somber greens of *ficus*.

In the open air, the use of palms, tree ferns, dracenas, crotons, caladiums, and *ficus* for summer decoration is not widespread. On large estates and in parks that can boast of greenhouses, a group planting of these subjects in the summer in the open is often to be found. In this case the outdoor use of the plants is more or less for the good of the plants and therefore little care or study is given to the grouping. The plants are "turned out to pasture" to rest up from the strenuous winter and stiffen their stems and roots for another year. Their winter appearance is their main purpose. Sometimes, especially in parks and botanic gardens, the plants are grouped by family or ecology, as a succulent group, desert group, or palm group, keeping closely to their winter arrangement under glass, more to put them under somewhat natural conditions for their best growth that they may require less personal attention from the gardener, than from a desire for any definite landscape effects.

The nearest approach in the United States (outside the very southernmost parts) to the tree-like palm vegetation of the tropics and subtropics is in the palmetto (Fig. 3013; also Fig. 3516, Vol. VI), which is native as far north as North Carolina, and is very useful as a decorative plant.

The smaller-growing subtropical plants are much used in the production of the most studied designs in planting, namely, in the construction of floral patterns, the very precise designs of city seals and the emblems of the many secret orders, "floral signs," and rarely, as in Regent Park, London, in the making of floral clocks. In these plantings, use is made of *celosias*, *alternantheras*, *coleus*, and *echeverias* and other tender succulents. This use of plants is decidedly on the wane on private estates and in the larger parks, for it has not now the sanction of fashion for the making of permanent seasonal garden features, but it has a value as display in horticultural or other exhibitions as a temporary affair, showing gardeners' ingenuity.

One great use of individual subtropical plants in pots has been in formal gardens as decorative adjuncts. These are then distinct garden features, garden accessories of rank similar to statuary and special flowerbeds. For such effects, large "orangeries" were maintained in the great day of the formal garden in Italy and France, and the use of such plants has been retained in our elaborate gardens today.

In park planting, the use of subtropical plants often produces pleasing pictures, but only when the entire

surroundings are very artificial and refined. Since the final character of a finished planting is based solely upon the foliage mass, plants of the same character only should be used in the separate plantings. The most natural effect is gained when the plants are grown in the ground, either with the pots plunged or planted directly in the soil. For this purpose the plants must be given conditions under glass to keep them alive all winter, but not necessarily in active growth, or kept in a dormant condition in pits, or stored as tubers. Plants for this purpose may be thus grouped—the taller woody plants to give height of green foliage to the group, low tender flowering herbs to give color from leaf or flower, and bulbous plants for bold leafage or bright flowers as fillers among the foliage plants.

Plantings of this kind involve considerable yearly cost for storage of potted plants or tubers, and great expense of annual planting and digging. Then there is a

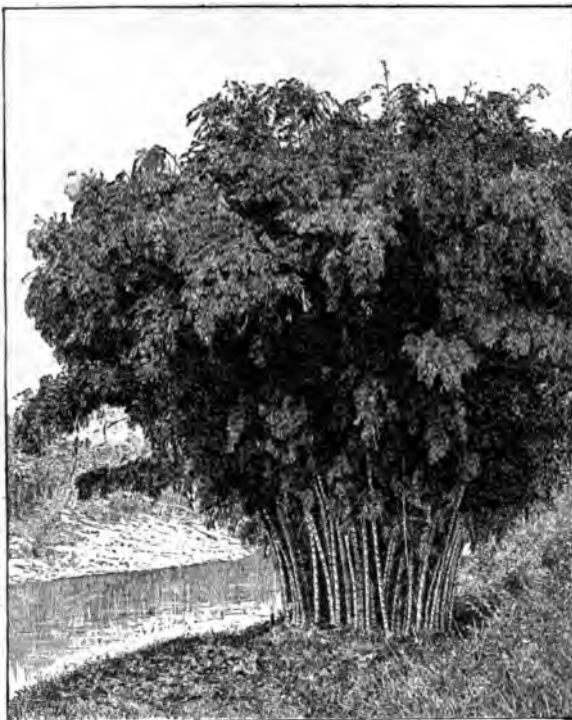
comparatively short season of foliage and flowers, from the time that the semi-dormant vegetation gets under way in July until cut down by early frosts. Yet effects not otherwise to be secured by plant materials can be given gardens and parks in this way. This is a use of tender plants that will be greatly developed in the future, by park superintendents and owners of large estates who have the courage to break away from the usual specimen or jumbled planting, and make real garden pictures. There is very little of this kind of gardening as yet. The temporary tropical foliage of our summer gardens is much more effectively used today than it was a few years ago, but the problem must be studied more carefully before the best possible use is made of this material.

The ideal subtropical garden gives in a small compass the feeling of the wonder and luxuriance of the vegetation of the tropics, and suggests some of its pictures, whether under great glass roofs or in the open ground in the summer.

WARREN H. MANNING.

Plants for the seaside.

Very distinctive types of American scenery are to be found along our seashores. The very dark green mangrove thickets come to the salt-water's edge on the Florida and the Gulf coasts with a backing of savannas of tall grasses, fringes, and islands of palms, and gloomy thickets of cypress trees draped heavily with the hanging gray moss-like *tillandsias*. Farther north on the Atlantic coast are great hills and sweeps of sand-dunes, constantly shifting, overwhelming the stunted growth of pine, cedar, oak, and maple. Here the sand-reeds push out their long fingers of undergrowth and root-fibers to hold the sand in place, and they establish conditions for shrubs of huckleberry, rose, deciduous holly,



3012. A tropical growth.—Giant bamboo in the Botanic Garden of Ceylon. *Gigantochloa atter*.

baccharis, and iva, and give protection to the young forest trees. Along the rock-bound New England coast are wind-swept compact masses and distorted individuals of cedar, pitch and Norway pine, corresponding in a way to the similar Monterey pine and cypress of the Lower California shore. With the pines and oaks of New England are maple and shad-bush with ground-cover thickets of bayberry, rose, beach plum, huckleberry, and baccharis, and compact evergreen mats of bearberry, crowberry, and hanging curtains of the prostrate juniper over faces of ledges. In the salt-marshes are great patches of the rich green sedges, and in the flats the brilliantly colored samphires.

The main thing to be considered in the development of this native growth is to let it alone when it is well established. On the drifting sands of the dunes and plains of the seashore, plantations of the beach-grasses are made and protected as well as plantations of pines and shrubs. In California certain lupines and acacias have been successful, together with the reed, in holding the drifting sand.

There are two kinds of seaside planting: the adaptation of the usual species used in the lawn and garden to seashore conditions for effects like the usual refined planting; the other the planting for definite seaside effects by the almost exclusive use of typical maritime flora. This second kind of seashore planting is rarely attempted, as natural seaside pictures are hard to imitate. The problem as usually conceived is one of finding plants that will endure seaside conditions.

The tidal marshes are always fully planted by nature, and man can add little to good purpose. In sheltered bays, especially where the soil is good, the existing flora usually differs little from that common to the region inland, and it is no great problem to add to it. Even on the most exposed sites there is a low herbage and stunted undergrowth while a few picturesque wind-twisted trees give special distinction to the landscape. Even evergreen trees are often found near the shore-line, and the black spruce on the Maine coast, pitch pine and red cedar in southern New England, Jersey pines on the sand-barren coast of the middle states, and farther south bald cypress, until this gives way to the tropical palmetto and mangrove.

Given partial shelter near the taller woody plants, many low shrubs and herbs may be grown near the seacoast. There are many showy natives in the maritime flora and many more may be brought from Europe, though few have been tried as yet. The salt in the soil or water is rather a minor factor to many plants. More important to their welfare is the light sandy or heavy clay soil on the seashore above the tide-line. For the woody plants, the great factor is the high wind which stunts the branches and foliage. Though the winds are high, yet the temperature is more even and usually higher than at the same latitude inland. This is a favorable factor.

Since the sheltered nooks are not at all difficult to plant, it is on the exposed sites where the soil is poor that the problem is usually specially considered. If the soil is wet just above the tide-line, the beaches need no planting to hold the soil in place. When the soil is light and dry and shifts with the wind, not only is root-hold for the plants difficult, but the wind-driven sand cuts the twigs and foliage. It is here, where wind and wave meet, that several grasses do good work in holding the shifting sand in place until larger-growing plants can get a foothold. Two good sand-binders are the beach-grass (*Ammophila arenaria*) and sea lyme-grass (*Elymus arenarius*). These can be set out as small plants or the seeds sown upon the sand. Immediately branches or heavy straw should be thrown on to hold the sand for a time until the grass takes hold. When these tall grasses are established, they may be reinforced by lower tufted grasses, such as fescue and stipa.

Immediately back of this line of exposure should

begin the shelter-belt of trees and shrubs. This would consist of quick-growing trees, such as some of the willows, poplars, locusts, and some of the native cherries (*Prunus serotina*, *P. pennsylvanica*, *P. virginiana*, and the like). These are to be followed by more permanent material, such as the stiff thick-growing thorns and native crab-apples, and the species of oaks and other native forest trees that will live in light soil. Trees with large or compound foliage are to be avoided. Several coniferous evergreen trees thrive in conditions close to the salt-water, particularly the white spruce, pitch pine, red cedar, and their geographical relatives. A great many trees, even the sturdiest natives, cannot thrive under extreme conditions along the seashore.

Beneath the partial shelter of groups of trees, a great many shrubs will thrive under the handicap of sand and salt and wind. Particularly worthy of note are such common shrubs as *Baccharis halimifolia*, *Lycium halimifolium*, *Lagustrum vulgare*, *Shepherdia canadensis*, *Hippophae rhamnoides*, *Salix viminalis*, *Rhamnus Frangula*, *Cornus paniculata*, *Rhus copallina*, and the like, and among the beach-grasses *Prunus pumila*, *P. maritima*, *Myrica carolinensis*, *Cytisus scoparius*, and the

species of *Tamarix*. To tie the shrubs together, several vines, as the native species of grapes, *Celastrus*, and *Smilax*, are very useful.

For details of color, masses of native or exotic perennial herbs may be grown. In dry soil select some of the species of *Armeria*, *Sedum*, *Lathyrus*, *Asclepias*, *Liatris*, *Silene*, *Statice*, *Opuntia*, and so on. In wet soil try the native species of *Hibiscus*, *Iris*, *Acorus*, *Thalictrum*, *Lythrum*, *Solidago*, and their



3013. The palmetto or sabal of the southeastern states.

near exotic relatives. The splash of salt-water is often fatal to many annuals, but those hardy annuals that like light warm soils, as portulaca and the Shirley poppy, will give masses of bright summer color. In the planting of herbs, there would be no special soil-preparation, or after-care, as refined garden effects are here out of place.

Three distinct purposes are served by a judicious seaside planting: shelter from strong winds to benefit the crops and man, checking of shore erosion and sand movement, and definite landscape effects. One should not so much strive to secure gardenesque effects but rather to intensify the natural features of the landscape.

Examples of successful seashore planting are numerous along the coast of New England where summer colonies of the wealthy have been established, parts of Long Island, and in many places along the coast of the Middle Atlantic states. The first work in seaside planting in this country was to prevent shore erosion, and from this work have developed the further uses for shelter and landscape effect. The problem of the shores of the Great Lakes is very similar, and much excellent

work has been undertaken along the shore of Lake Michigan, just north of Chicago. A consistent plan for the development of this particular shore has been advocated.

There are few books devoted wholly to the problem of seashore planting, and much experimenting is yet to be done. See "Seaside Planting of Trees and Shrubs," by Alfred Gaut (England) and "Gardens Near the Sea," by Alice Lounsberry. WARREN H. MANNING.

Succulent plants and their culture.

Succulents are fleshy plants of many kinds, but forming a cultural group well known as such to gardeners. They are grown mostly for their striking or grotesque usually condensed form, and not for the verdurous character of foliage and spray; and some of them are notable for their showy bloom.

This aggregation of plants is comprised of genera and species of several very remotely related families. Cactaceæ, perhaps, contains the largest number of genera and species belonging to this group, although not all members of the family are strictly succulent in



3014. A formal bedding design in succulents.

habit. Next in point of number is undoubtedly Amaryllidaceæ, represented by *Agave* and *Furcraea*, with Euphorbiaceæ as a close third, represented almost wholly by the great genus *Euphorbia*, although a few species of *Pedilanthus* are to be included. Crassulaceæ comprises a large number of genera and species, nearly all of which are succulent in habit of growth, although comparatively few genera are common in cultivation. Conspicuous among these crassulaceous things may be listed *Bryophyllum*, *Cotyledon*, *Crassula*, *Echeveria*, *Kalanchoë*, *Sedum*, and *Sempervivum*. In Asclepiadaceæ the group is represented chiefly by *Stapelia*, although, to a limited extent, one finds in cultivation representatives of *Caralluma*, *Ceropegia*, *Duvalia*, *Echidnopsis*, and *Heurnia*. Bromeliaceæ gives two genera, *Dyckia* and *Hechtia*. Liliaceæ contributes *Aloc*, *Apicra*, *Gasteria*, *Haworthia*, and a comparatively small number of species of *Yucca*. The great family of Compositæ has representatives in a section of the genus *Senecio*. By some authors this group of *senecios* is considered as having generic standing under the name *Kleinia*.

In their wild forms, succulents are native to widely separated geographical areas, for the most part being indigenous to the arid or semi-arid regions of Asia, Africa, North and South America, and the West Indies. They have this in common, however, that the climatic and soil conditions of these remote habitats are comparable and such as to induce just the characteristic growths that these plants exhibit. For this reason they are usually brought together, in cultivation, and given the same or very similar treatment.

The use of succulents.

Many of the succulents are very attractive and ornamental grown either as single specimens, in groups of one class, or when different genera and species are brought together in mixed planting. For the most part

the agaves are too large and bulky to be used to advantage other than as single specimens and a few species are not uncommonly employed in this way. Among these may be mentioned *Agave picta*, the variegated forms of *A. americana*, *A. atrovirens*, and *A. Milleri*. They are commonly grown in tubs to facilitate handling. Thus treated, they are housed in winter and in summer are placed in some favorable location on the lawn. Some of the best yuccas are hardy as far north as New England and the lake region. *Yucca filamentosa*, *Y. gloriosa*, and *Y. glauca* have received considerable attention. They are attractive as single specimens, in small groups on the lawn, or when used as border plants with a shrubby background. In summer they produce large panicles of showy white waxy flowers which are very striking throughout the daytime and are especially so by twilight. The foliage being evergreen gives an added value to the plants for winter effects. A considerable number of this group of plants is well adapted for use in window-gardens. The very grotesqueness of some and the remarkable symmetry of others appeal to one's interest as much as do many gaudy and highly colored flowers of other classes of plants. Furthermore, a large proportion of these plants produce very excellent flowers, and frequently the resulting fruits are equally showy. Among the species valuable for individual pot-plants may be mentioned the following. Nearly all the *echeverias* are attractive in both foliage and flower characters. The globose and stemless rosette forms of *sempervivum*, commonly known as hen-and-chickens, are especially noteworthy. The production of numerous offsets and these appearing from beneath the foliage of the parent are very interesting and suggest the application of the common name.

A very large number of the smaller cacti deserve consideration. The crown of flowers, followed by a like crown of colored fruits, is particularly pleasing. The numerous species of *stapelias* are easily grown and in the autumn produce a variety of strikingly showy flowers. Their one objectionable feature is the disagreeable odor of the freshly opened flowers, but this passes away in a very short time, while the flowers remain open for several days.

Not all the succulents lend themselves well to ornamental planting, although many can be thus used and very pleasing effects are produced. The small globular and short cylindrical cacti, with their great diversity in color of the plant-body and of the spines, give material for very effective combinations in design work. They have this advantage over foliage plants used in such work, inasmuch as their growth is so slight that the plants may be placed close together at the beginning and, without any special subsequent care, the design thus formed will retain its full outline throughout the season. A suggestion of the possibility of using cacti in this way is to be seen in the accompanying illustration (Fig. 3014). For this class of planting *echeverias* are undoubtedly the best material obtainable. The individual plants are equally as symmetrical and pleasing as the cacti, and the range of color variations among the species is fully as great. They have the added advantage that they can be propagated more easily and more abundantly than is possible with cacti.

When a large number of mixed genera and species of succulents is available, exceptionally attractive plantings may be produced by a combination of these in more natural rather than formal designs. (Fig. 3015.) These appear to best advantage when planted among rocks and the soil surface covered over with gravel and sand. Such treatment not only gives a more natural appearance to the planting but is advantageous because it keeps the plant-bodies from coming in contact with

the earth, which to most of them is very injurious if the soil is wet for any considerable time. In northern climates these beds must necessarily be but temporary combinations, to receive the plants for the summer months. In the south and southwest regions, where most of the succulents are quite hardy, the planting may be made permanent. In such cases very pleas-



3015. An informal planting of succulent subjects.

ing effects are produced by planting on a sloping surface, in more or less raised beds or, better still, in rockeries.

The cultivation of succulents.

For a general rule, it may be stated that all succulents require an open porous sandy soil and perfect drainage. Other conditions, such as watering and atmospheric humidity and temperature, must vary somewhat with individuals or with special groups. Nearly all the species are very easily grown from seed, although in many cases vegetative reproduction is more available. In fact, some species have natural adaptations for propagation in this way as well as by seeds, and quicker returns may be had from the vegetative methods. The method employed in propagating cacti from seed has given equally excellent results when applied to all other genera of succulents and is therefore given in all essential detail.

Cacti are especially easy to start from seeds and with proper care may be readily brought to maturity. Experience teaches that such plants are better adapted to greenhouse treatment than those brought in from their native wilds. The latter suffer from the shock of radically changed conditions. For a germinating vessel, nothing can be more convenient than a 3- or 4-inch pot. If not fresh from the pottery, this should be thoroughly sterilized. Sterilization can be accomplished by soaking and washing in a dilute solution of copper sulfate (blue vitriol) and subsequently rinsing well; or the pots may be placed in a furnace till all organic matter has been destroyed. This sterilization is necessary for the reason that the seedlings must remain in the seed-pot for a considerable time before it is possible to transplant them. If not sterilized, the pot is likely soon to be covered with algæ or other organic growth and this, spreading over the surface of the soil, will quickly smother the young plants. For the same reason also, the soil should be thoroughly sterilized. This seeding soil should be very sandy with only sufficient humus mixed with it to furnish food for the young plant, of which a very little is sufficient. To insure perfect drainage, the pot is filled at least one-fourth full of broken bits of pots or charcoal, on top of which is placed the soil up to about $\frac{3}{4}$ inch from the top. This is jarred down lightly and the surface leveled. The seeds are then scattered evenly over the surface and firmed down with a flat-faced cylindrical block. Over the seeds is placed a layer, about $\frac{3}{8}$ inch deep, of fine gravel not

larger than a small pea. One of the chief drawbacks in growing cactus seedlings is their susceptibility to "damp off" in their younger stages. The protection afforded by this layer of gravel removes that danger. It also prevents any baking of the surface of the soil. The pots are then placed in a pan of water and allowed to remain until the water shows on the surface of the soil. Subsequent watering can be accomplished with a fine spray, applied to the surface of the gravel.

After planting, the seed-pots should be placed on a bench which is insulated in vessels of water or, better, in water with a surface coat of oil. This oil is to exclude ants, which have an especial liking for cactus seeds. Best results are secured in a humid atmosphere and a temperature of at least 70° F. The seedlings of most genera ought to appear within ten days, but *Opuntia* may require a little longer. When the seedlings begin to show spines, they may be transplanted into small flats of earth into which a little more humus or sod soil has been mixed. They may remain in these flats for one to several years, depending on the rapidity of growth in different species. Eventually they are potted off as individual specimens or placed in the open ground.

It is only in the southwest states that many of the cactus plants are hardy enough to be permanently planted out-of-doors. Throughout the greater part of the United States they are tender and require greenhouse protection in winter. In this colder region they may be planted in the open ground of a conservatory, where they thrive excellently, or they may be kept in pots in winter and, in the hottest part of summer, be removed to the outside and the pots plunged in beds.

Almost any cactus will readily strike root from cuttings. The cut surface must be allowed to dry for several days, until a corky layer has formed over it. The cutting may then be placed in sand to root, its base but little below the surface. If slender, the cutting should be tied in position to a supporting stick.

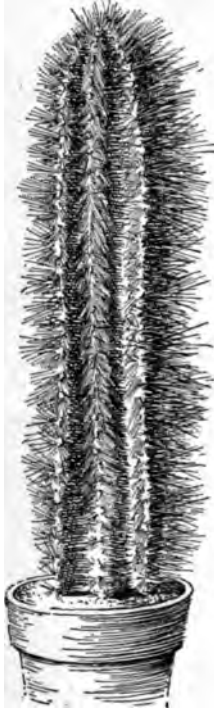
Grafting of cacti is almost unlimited in its possibilities, although employed only in particular cases. Small globose forms, such as *Mammillaria* (Fig. 3016), *Echinocactus*, *Echinopsis*, and others, are frequently grafted on some abundantly rooting *Cereus*. Good stocks are provided by *Cereus Bonplandii* and *C. tortuosus*, though



3016. A condensed cactus form.—*Mammillaria micromeris*. (X 1)

almost any of the smaller columnar forms may be used. With these cions and stocks, it is necessary only to make a smooth horizontal cut across each and place the two flat surfaces together. The cion is held in position by placing soft strings or raffia over it and tying the ends firmly about the stock or to sticks thrust into the earth. *Zygocactus* (the old *epiphyllum*), *Rhipsalis*, and

Aporocactus (or *Cereus*) *flagelliformis*, which are epiphytic species, do well when grafted on slender upright species of *cereus*, but are more commonly placed on *pereiskia*. If *zygocactus* is used as a stock, cleft-grafting is usually employed; if *ripsalis*, either the cleft- or saddle-graft. Cristate forms treated as cuttings usually develop normal-formed new growths, but when grafted will continue the cristate character.



3017. An elongated cactus form.—*Lophocereus* Schottii.

Although it is possible for cacti to survive a long drought in nature, yet when grown in pots they are seriously injured if their roots remain dry for any considerable time. They should not be placed on benches over the heating-pipes, where the soil soon dries. It is desirable to have the soil cool and the air overhead warm and rather dry for all desert forms. Contrary to a prevalent opinion, they require water. This should be applied in sufficient quantity only to keep the soil moist. A saturated soil quickly induces a soft watery rot which is fatal to the plant. This is especially likely if the soil contains any organic matter that has not been thoroughly decomposed. A small amount of lime in the soil is desirable, and soil should never be sour. Perfect drainage is necessary at all times.

Many species of *cereus* and *phyllocactus* (now properly *epiphyllum*) climb over trees or rocks by means of aerial roots. These are indigenous to the more tropical regions and should be grown in a separate room from the desert forms, in one where the atmosphere can be kept at a higher degree of humidity. They should, also, be provided with suitable supports on which to climb. *Zygocactus*, *ripsalis*, and other epiphytic cacti, may be successfully grown in this same room, but suspended in baskets in the way in which orchids are treated.

Agaves and *furcraea*s, although readily grown from seeds, are more commonly propagated from suckers, or from the bulblets produced in abundance in the inflorescence of many species. For these plants a good soil is one of half sod and half sand. In nature they do not form deeply penetrating roots but widely spreading horizontal feeders. In pot or tub culture, the roots quickly reach the walls of the container and the plant very soon becomes pot-bound. Furthermore, if the container is allowed to remain dry for any time the roots are seriously injured thereby. When possible, it is better to plunge the pots or plant directly in open ground.

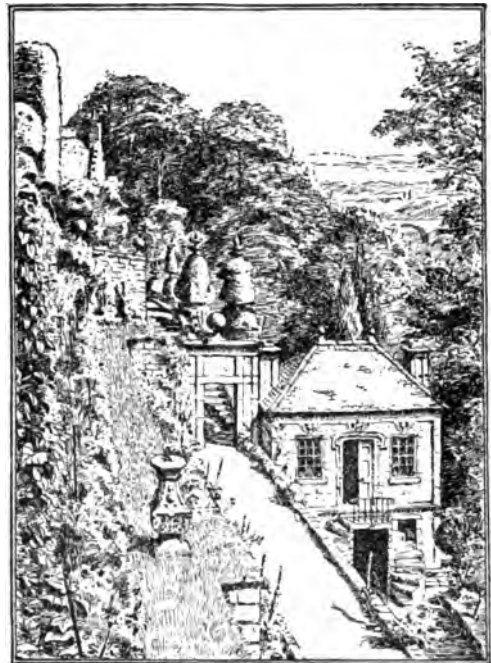
Euphorbias and *pedilanthuses* are best treated in every way as are the cacti. Their cultural methods differ but very little. While it is possible to grow them from cuttings, it is less easily accomplished than with cacti. The cut surface should be placed immediately in powdered charcoal to check the flow of milky sap. When the surface is thoroughly dry, the cutting may be rooted in finely broken charcoal or in sterilized sand. These plants are very susceptible to bacterial rot. Grafting is possible but difficult. It is sometimes employed to preserve a cristate growth of the cion.

Most genera of *Crassulaceae* are propagated more readily from seeds or from stem-cuttings. There are a few noteworthy exceptions, however. *Bryophyllum* can be more quickly and just as abundantly multiplied

by placing matured healthy leaves flat on wet sand and kept in a moist warm atmosphere. In a very short time tiny plants will appear in the notches about the margin of the leaf (Fig. 673, Vol. I). When of sufficient size these may be removed and potted as individual plants. In most species of *echeveria*, multiplication is best accomplished by carefully removing the healthy mature leaves and placing them on sand as with *bryophyllum*. The base of the leaf must not be injured, for it is from this point that the one or more young plantlets develop. The leaf-like bracts on the flowering stock of many species are very easily detached and propagate even more readily than the normal leaves. The above method is adapted to the acaulescent species of *echeveria*. With the caulescent species the rosette is cut from the top of the stem and treated as a cutting. The parent plant, thus pruned, will soon throw out a number of growths from the dormant lateral buds. As soon as these have formed rosettes of about an inch in diameter they, too, may be removed and will readily grow as cuttings.

Many *Crassulaceae*, and *echeverias* in particular, suffer severely from attacks on their roots and the base of the stem by nematodes. For this reason only clean fresh or sterilized soil should be used in growing them. The various genera and species may be grafted back and forth but no special advantage is to be gained by the process. It is also possible to hybridize between the genera and the species, and a number of interesting results have been secured. Some of the *echeveria* hybrids have proved to be valuable additions to the group used in design work or for bordering other beds.

Asclepiadaceae is most commonly represented in collections by the genus *Stapelia*. These plants fare excellently when given the treatment recommended for cacti. The chief difficulty in growing them, in the past, seems to have been their proneness to decay at the surface of the soil, especially in wintertime. This is easily prevented. See that the drainage is perfect and use porous sandy soil. Spread the roots out on the surface of the soil and cover not more than $\frac{1}{2}$ inch deep with more soil. Over this place an inch layer of gravel about



3018. A garden scene in which topiary craft is a feature.

the size of peas. Their susceptibility to decay at the surface is comparable to the damping-off of seedlings. The mulch of gravel is invaluable in remedying both maladies. Keep the soil moist but never saturated, and do not permit the roots to become excessively dry. This treatment will insure good continuous healthy growth and, in autumn, a reward of many attractive flowers. The other genera require like treatment. Grafting of genera and species is easily effected but of no special cultural value. Owing to the highly specialized structure of the flower in *Asclepiadaceæ*, it has thus far been impossible to effect artificial pollination, although natural hybrids, through the agency of flies, are very common. This is especially true in *stapelias*. Bigeneric hybrids have been reported.

Dyckia and *hechtia* of the *Bromeliaceæ* and *yucca*, and the aloe group of the *Liliaceæ*, should receive the same treatment as agave. The species are more commonly propagated by seeds, and the hybrids by division and stem-cuttings or division of the crown. *Senecio* (*Kleinia*), of the *Compositæ*, may be propagated either by seeds or by cuttings. With them, also, grafting is possible.

C. H. THOMPSON.

Topiary planting and garden architecture.

Topiary work includes sheared hedges, pollarded trees, clipped individual shrubs, whether shaped into simple, rounded, or pointed form, or into more elaborate designs. It includes the trimming of masses of foliage into the form of birds, beasts, furniture, architecture, and other conceits. The more intricate designs are usually attempted in evergreen plants.—Garden architecture comprises all structural or architectural elements introduced into the landscape except the main buildings that are to serve the primary uses of a property. This definition thus includes all walls, trellages, posts, gates, pavilions, exedras, loggias, pergolas, shelters, fountains, bridges, seats, pavements; closely related with it are garden and lawn ornaments and furniture, such as statuary, vases, urns, dials, bird-fountains, lanterns, and the like. It includes the plain, the simple, and the rustic, as well as the more elaborate, ambitious, or ornate. Virtually all of the historical architectural styles are represented or suggested in the forms of garden architecture. For interesting illustrations and discussions of these subjects, the reader should consult Blomfield and Thomas, "The Formal Garden" (London), from which Figs. 3018 to 3023 are adapted. Compare, also, Fig. 3025. Fig. 3024 shows a common form of vase, used not so much for its architectural placing as for a receptacle in which to grow flowers.

Topiary and garden architecture, although distinct and separate, are nevertheless essentially related, both in origin and in use. Both have their inception in the virtually universal formality of all early landscape design, and historically and at the present day they frequently stand side by side as related elements of a design.

For many centuries gardening was conducted behind inclosing and protecting walls, a practice made necessary by the uncivilized conditions. In general, such inclosed gardens were rectangular or geometrically regular, and comparatively small. They existed in immediate proximity to the owner's dwelling or adjacent to the building. The necessity of conserving ground and of utilizing it most efficiently lead naturally to arrangement and planting in straight lines and rows. Utility having thus first determined a regular arrangement of plant-materials in close proximity to architecture, esthetic composition, in its turn, attracted the attention of more cultured man and formal design in landscape gradually evolved.

Both garden architecture and topiary are attributes of the formal in landscape design, which is determined

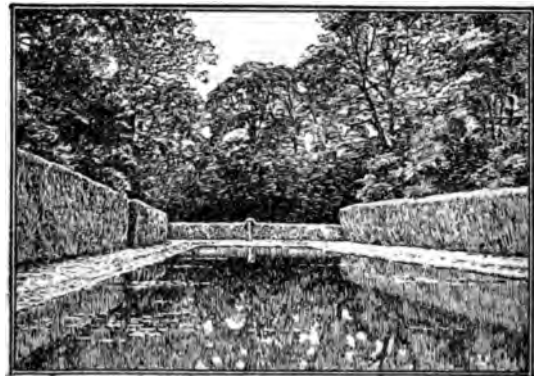
by lines, axes, and balance of parts. The inappropriate use of either results in inharmonious and bad design and constitutes an esthetic abuse.

The following plants are well adapted to topiary treatment:

NOTE: E means plants evergreen.
P means plant must be protected in climate of Boston.
S means plant is semi-evergreen.

Acer campestre.
Acer platanoides var. *globosum*.
Berberis Thunbergii.
E—*Buxus japonica*.
EP—*Buxus sempervirens*.
Carpinus Betulus.
Carpinus Betulus var. *globosa*.
Catalpa bignonioides var. *nana* (=C. *Bungei* in the trade but not the true C. *Bungei* from northern China). A dwarf variety of the southern *catalpa* often grafted high on upright stem.
E—*Chamaecyparis nootkatensis*.
E—*Chamaecyparis obtusa* var. *nana* (= *Retinispora* in the trade).
Cornus mas.
Crataegus Oxyacantha.
Evonymus alata.
E—*Evonymus radicans*.
EP—*Ilex crenata*. (A small-leaved variety of this has grown in the Arnold Arboretum at Boston entirely unprotected.)
E—*Ilex glabra*.
Ligustrum Iboia.
Ligustrum Iboia var. *Regelianum*.
PS—*Ligustrum ovalifolium*.
S—*Ligustrum vulgare*.
E—*Picea excelsa*.
E—*Picea orientalis*.
E—*Pinus Cembra*.
E—*Pinus densiflora* var. *pumila*.
E—*Pinus montana*.
E—*Pinus montana* var. *Mughus*.
E—*Rhamnus cathartica*.
E—*Taxus cuspidata*.
E—*Taxus cuspidata* var. *brevifolia*.
E—*Tsuga canadensis*.
Viburnum Opulus var. *nanum*.
Viburnum prunifolium.

In the growing of the plants for topiary use, no special care is required except to be sure that the plants are well grown in the nursery, vigorous, and naturally thick-topped and fine-twigged. If the piece



3019. A wall inclosure of topiary work.

is to be a hedge or continuous line, the plants should be very uniform in size and vigor when set and the ground should be prepared in uniform condition so that all the subjects will have equal chance. The plants should be set close together. Clipping should be begun soon after the plants are established to keep them close and to develop and preserve the side and lower branches; and the clipping should be practised several times each year. If the plants once overgrow, so that they become open and scraggly below, they can never be brought into good condition. Great care must be exercised to see that insects and disease do not get started, and that the plants suffer neither from drought nor wet feet and that they are well supplied with nourishment. See *Hedges*.



3020. Topiary walls and a dial.

Topiary work, as well as architecture, appears in gardens of many different ages. In fact, the whole history of gardens but emphasizes the continued use of formal foliage and architecture as essential elements in their design. As stated by Blomfield, "The word 'garden' itself means an enclosed space, a garth or yard surrounded by walls, as opposed to an unenclosed field or woods. The formal garden, with its insistence on strong bounding lines, is, strictly speaking, the only 'garden' . . . ; and it is not till the decay of architecture, which began in the middle of the eighteenth century, that any other method of dealing with a garden was entertained." The common use of hedges for the inclosing of gardens doubtless came into use when the more settled conditions made it unnecessary to retain masonry walls for protection.

In the writings of Pliny the Younger, who was born A. D. 62, is the most complete description of the Roman gardens. In a letter addressed to his friend Appolinaris, he describes the garden attached to his Tuscan villa: "In front of the Portico is a sort of Terrace, embellished with various figures, and bounded by a Box Hedge, from which you descend by an easy slope, adorned with the representation of divers animals in Box, answering alternately to each other; this is surrounded by a walk enclosed with tonsile evergreens, shaped into a variety of forms. Behind it is the Gestratio, laid out in the form of a Circus, ornamented in the middle with Box, cut into numberless different figures, together with a plantation of shrubs prevented by the shears from running up too high; the whole is fenced by a wall, covered with Box rising in different ranges to the top" After describing several summer-houses he proceeds: "In front of these agreeable buildings is a spacious Hippodrome encompassed on every side by Plane Trees covered with Ivy. Beneath each Plane are planted Box Trees, and behind these, Bays which blend their shade with that of the Plane Trees. This plantation forms a straight boundary on each side of the Hippodrome. . . . Having passed through these winding allies, you enter a straight walk, which breaks out into a variety of others divided

off by box hedges. In one place you have a little meadow; in another the Box is cut into a thousand different forms; sometimes into letters expressing the name of the master; sometimes that of the artificer; whilst here and there little Obelisks rise intermixed alternately with fruit Trees; when on a sudden you are surprised with an imitation of the negligent beauties of rural Nature, in the center of which lies a spot surrounded with a knot of dwarf Plane Trees. Beyond these is a walk . . . where also Trees are cut into a variety of names and shapes. . . . At the upper end is an Alcove of white marble shaded with Vines, supported by four small Pillars of Corystian Marble. From this bench the water, gushing through several small pipes, falls into a stone Cistern beneath, from whence it is received into a fine polished Marble Basin, so artfully contrived, that it is always full without ever overflowing. . . . Corresponding to this is a fountain, which is incessantly emptying and filling; for the Water, which it throws up to a great height, falling back again into it, is, by means of two openings, returned as fast as it is received. Fronting the Alcove stands a Summer House of exquisite Marble, whose doors project into a green enclosure; as from its upper and lower windows the eye is presented with a variety of different Verdures. Next to this is a little private closet Here also a fountain rises and instantly disappears; in different quarters are disposed several marble seats, which serve, as well as the Summer House, as so many reliefs when one is wearied by walking. Near each seat is a little fountain; and throughout the whole Hippodrome, several small Rills run murmuring along, wheresoever the hand of Art thought proper to conduct them, watering here and there spots of verdure, and in their progress refreshing the whole."

The Romans, establishing themselves in England, built gardens in which topiary work was doubtless to be found. Otherwise, in England prior to about the eleventh or twelfth centuries, gardening as an art of design and taste can scarcely be said to have existed. It is recorded, however, that in 1123 Henry the First formed a park at Woodstock, and it is the first of which authentic record has been preserved. It was probably intended chiefly as a game-preserve but contained, however, a labyrinth. And it is recorded as the custom of the times for the nobility to develop pleasure-gardens in the orchards beyond the walls of their castles, the chief embellishments of which consisted in "plants cut into monstrous figures, labyrinths, etc."

It is in the gardens of England of the early Renaissance periods and shortly before this time that the most extensive use of topiary work is found, in the greatest variety and elaboration of form. Topiary art was practised, however, in all European countries for centuries. It has been given particular and peculiar expression in each of several countries. The Dutch developed the art of carving in verdure at an early date and many strange and curious forms in box, along with many rare and flowering plants, were introduced into England from Holland. In France and Italy it was not so much a large variety of elaborate and intricate topiary as an extensive use of the simpler forms of clipped foliage as a means of gaining effect in larger, more monumental, and pretentious landscape arrangements than were elsewhere undertaken. The architectural gardens of the Italian Renaissance exemplify the effective and appropriate use of architecture in the garden. Here trees, naturally formal in habit, are combined with sheared hedges and edgings. These wonderful gardens teach the remarkable effectiveness



3021. A bit of topiary craft.

of such method in design when executed by the master hand.

The designers of the tremendous and monumental landscape arrangements executed in France in the later Renaissance periods gained distinctive effects by the very bold use of sheared foliage; they virtually carved

their broad axially related plans out of the woodland. The "Bosque" in French design is comparable to the "Topiary grotesque" in the English. The French parterre gardens, in which intricate and elaborate geometrical designs are worked out in low sheared foliage or bed edging and white or colored gravel, are another expression developing from the same original motive as produced the topiary bird.

In the colonial gardens in America topiary work was common, mostly in the simpler form of clipped hedges, generally of box, and box-edged parterre gardens.

Remains of many of these old gardens are still to be found in the Atlantic states, and a few old gardens are still in a good state of preservation and cultivation. The box-garden at Mount Vernon is perhaps the most noted, and is in an excellently preserved and restored state at the present time. See Plate XLVI, Vol. III.

A moderate amount of interesting and good topiary work is under way in gardens in this country today, and a few nurserymen are in position to furnish good clipped specimens in a variety of designs. The use of topiary work other than simple clipped hedges should be carefully and advisedly undertaken, however, for it is appropriate only when the whole architectural style of a property makes it suitable and when it becomes an inherent part of the scheme as a whole.

Garden architecture.

Any structure or structural element placed out-of-doors in nature takes on the significance of architecture, and must bear judgment as such. Landscape as such is either nature's work or man's work with nature's materials in their natural form. The placing of architecture in the landscape is always the combining of the obviously artificial with the natural, and the two must be brought into harmony. It is a deplorable fact that when, with the exercise of judgment and good taste, it is possible to attain harmony in the least costly as well as in the most expensive, so much bad and inharmonious architecture encumbers the landscape.

Under any circumstances, architecture becomes to some extent a feature of accent in the landscape, at least within its immediate surroundings. It is emphatic in contrast with its setting and always functions as focalizing the composition of which it forms a part.

In general, it is wiser to attempt a simple design and insure its substantial construction than to undertake the ornate in garden architecture. There is a world of interesting precedent in simple designs for the many smaller architectural embellishments of the garden, such as summer-houses or pools, pavements, seats, dial-bases, boxes, tubs, jars, and other ornaments and accessories. The use of simple boxes or ordinary pots

for flowers and specimen plants is to be encouraged, and the conversion of such inappropriate materials as plumbing fixtures into garden ornaments is to be condemned. The usual cast-iron vases and the like are marks of a passing era of bad taste. In lawn pottery, in the form of pots and vases, excellent designs are now to be had, as also of sun-dials.

No one consideration is more important than that the architectural style of even the simplest seat or sun-dial be similar to that found in the larger architecture of the building or buildings to which the landscape development may be related.

A number of reputable firms now produce substantially made garden furniture in considerable variety of good designs and in many different materials. Particularly good garden seats and garden pottery are now obtainable at reasonable prices and may be found in shops in some of the larger cities. The advertisements and trade catalogues of the manufacturing concerns are interesting and instructive.

However, the obtaining of individually well-designed and substantial articles having been assured, there remains still the selection of appropriate patterns. Garden architecture should correspond to the style, architectural and otherwise, of a property as a whole. Its appropriate use is its justification.

Rustic work is fitting and often most appropriate in a naturalistic setting. It is, however, architecture and should be so designed as to bear analysis as such. It should be structural in its line, and substantial. It is best when simple and unobtrusive in design. It is seldom appropriate when fantastic or whimsical. The occasional use of rustic work in such way that in its rough character it appears almost to have grown up with the surrounding wild conditions is very pleasing, particularly good unobtrusive seats, bridges, and shelters.

EUGENE D. MONTILLON.

Planting for winter effect.

Winter is the season when there is the least sunshine, and the least sign of life and color in vegetation. As a floral festival, Christmas ranks second to Easter, owing doubtless to the relative scarcity and higher cost of materials. The ideal is for every family to grow its own flowers for Christmas gifts, but most persons have to content themselves with less personal products purchased from the florist. Holly is the symbol of Christmas as



3022. An attractive dial.



3023. Vase at Hampton Court.



3024. Stone flower vase 4 or 5 feet high, used as a plant basket.

the lily is of Easter, each exemplifying the dominant color of the season. The popular demand in winter is for signs of hope and courage—hence the red berry, flower, or ribbon.

The phrase "winter-garden" has been used for a great variety of projects, indoors and out, ranging from the metropolitan restaurant with a few bay trees in tubs, to a winter home in Florida where one may work outdoors every day and all day. Notable progress has been made along many lines since 1900 in the art of living the year round amid beautiful vegetation.

Indoor winter-gardens.

Perhaps the oldest use of the phrase winter-garden refers to a type of unheated or little-heated greenhouse which was popular in England when plants from the Cape and Australia were fashionable, but was generally a museum of potted plants rather than a garden. A new stage began in America about 1905, when Mrs. J. W. Stewart, of Glen Ridge, New Jersey, made a real garden under glass. (C. L. A. 13:168-70.) It has a broad lawn to tread upon, instead of narrow concrete walks, and in place of potted plants raised in tiers for show, there is a continuous border 3 to 4 feet wide, with bulbs and other flowers growing out of the earth at the familiar garden level. The temperature is that of a living-room. Another new stage began in 1906 when the conservatories in Garfield Park, Chicago, were completed. These were not the first attempts at landscape gardening under glass on a large scale, but they are believed to be the most impressive series of indoor nature-pictures in the world. Portable greenhouses and window-gardens now make it possible even for renters to have something more than a few potted plants on the window-sill. Those who can afford no glass may at least force twigs in water, preferring the early bloomers, like peach, plum, and forsythia to the late bloomers, like lilac and dogwood. In this line, the most notable achievement, of late, is the forcing of stems 6 to 8 feet high, by keeping them in a slightly heated attic until wanted for the living-room.

Outdoor winter-gardens.

The southern states have a winter climate that makes outdoor work pleasant, and a landscape rich in types of beauty, as evergreen magnolias, long-leaved pines, and winter roses. Southern winter-gardens have their problems, but they can receive less notice here than the more acute problems of northern climates. A country with an evergreen grass, like Ireland, has a great advantage over America for winter beauty. English children are well protected from bitter winds by the omnipresent walled-garden or high-hedged home grounds. The formal winter-garden of England is often merely a



3025. A winter-garden, presenting evergreen forms in tree, bush, and box borders.

straight walk, between high walls of clipped yew. Wordsworth's winter-garden is an early example of the naturalistic winter-garden, i. e., a sheltered spot surrounded by informal masses of trees and shrubs noted for their winter attractions.

In the northern states, however, it is neither safe nor pleasant to garden out-of-doors every day, and the winter landscape is commonly bleak, ugly, bare, or commonplace. Our most pressing problem, usually, is shelter from winds. On the plains and prairies many homes are surrounded by shelter-belts, but the landscape effect is not the best, owing to the artificial outlines of the farmsteads, the ill-concealed barnyards, and the inferior species used—soft



3026. A good winter form.—One of the *retinisporas*.

maple, box elder, Norway spruce. Windbreaks in straight lines, protecting orchards or stock, sometimes give a spirited army-like effect, but may become monotonous in a country where everything seems to be rectangular. In the East naturalistic shelter-belts are commoner. The practice of moving large evergreens with a half-frozen ball has developed notably since 1900, and full-grown evergreen hedges can be secured to shelter winter playgrounds.

Most persons see little beauty in the northern winter landscape. It is true that the East has little brilliant color or living green compared with England, China, or Japan, while the prairies and great plains have still less. Nature-study, however, opens the eyes of the people to a new world of beauty in outline and structure of trees, their trunks, and winter buds. The universal instinct for bright color, however, ought also to be gratified, and every family can receive and give satisfaction by means of foundation planting. Unfortunately, New York and Philadelphia may not have monumental evergreens to the extent that every London yard has box and holly, aucuba and veronica, yet many eastern homes may have mountain laurel on the sunny sides and rhododendron on the shady sides. Among the conifers most persons prefer the brilliant quick-growing but short-lived Japan cypresses, while lovers of permanence are willing to wait for Canadian and Japanese yew, Mugho pine, and Canadian juniper. Two superb evergreen vines, European ivy and evergreen bittersweet (*Evonymus radicans* var. *vegeta*), enliven house walls of brick and stone. On sunny days the red branches of Siberian dogwood are a cheery sight. Among the shrubs with brightly colored berries, the favorite for foundation planting is the Japanese barberry, largely because its red fruits are attractive all winter.

Types of winter-gardens.

Evergreen winter-gardens.—Perhaps the oldest type of winter-garden is the pinetum, which is primarily a collection of evergreens, but is also full of beauty during the period when other trees are leafless. One example is the Hunnewell collection at Wellesley, Massachusetts, part of which is doubled in beauty by reflection in a lake. Another example is the conifer valley in the Arnold Arboretum, which has a brook meandering through the center, while the heights are crowned by trees, the cultivated specimens on one side being balanced

by a noble hemlock forest on the other. In the pinetum at Highland Park, Rochester, New York, the walk runs through the grassy center of the valley, with dwarf evergreens ascending the banks, these being disposed at convenient levels and distances for the eye, so that the different textures may be enjoyed to the full. The



3029. Attractive winter objects.—Cones of white pine.

apparent height of this shallow valley is increased by planting the ridges with the tallest evergreens.

Shrubby winter-gardens.—Every arboretum or botanical garden is likely to have a fruticetum, or collection of shrubs. A garden composed almost exclusively of shrubs is attractive throughout the growing season, as well as during winter. There is a naturalistic winter-garden at Llyndanwalt, Abington, Pennsylvania, where a wood

of about an acre near the house has been provided with features of year-round interest, including a rhododendron collection, a dense underplanting of young hemlocks, and a border of shrubbery selected with special reference to winter beauty. From the outside, these shrubs give privacy, shelter, and color in delightful contrast to the ordinary wooded pasture, which is rather colorless. From the interior these shrubs animate the trails and enliven the outlooks that have been purposely left toward the best features of the landscape.

Skating-ponds.—It is now the fashion to border skating-ponds with shrubs that have brightly colored twigs. On sunny days these furnish bold masses of color that harmonize with the vigorous mood and gay costumes of the skaters. After providing for the casino and for the snow that must be removed from the ice, there is generally ample room for a collection of showy dogwoods, willows, and wild roses. At Rochester, New York, is a charming example, the shrubs being allowed to interlace like an old woodland border, so that the color of the twigs steals upon one unconsciously.

Gardenesque effects.—That it is possible to spoil even a winter landscape by overdoing color has been much demonstrated recently in parks, where nurserymen and gardeners have been allowed to plant large masses of Siberian dogwood and salmon-barked willow, the brightest of all winter reds. Such swamp-type plants are particularly inappropriate and gaudy on hilltops. A more poetic effect is produced by the "sunset willow" of the prairie states, a species of uncertain botanical status known to collectors as *Salix longifolia*. It is common along middle-western streams. The most brilliant but least tasteful effects produced with shrubs that have brightly colored bark are in reality the carpet-bedding system. The willows and dogwoods are cut to the ground every year or two, in order to produce the greatest number of showy shoots, which are kept at a height of about 3 feet. This system sacrifices height, habit, and dignity to display. A standard park effect is white pine bordered by Siberian dogwood, which is about the strongest contrast that is in good taste on lawns. Perhaps the strongest contrast furnished by nature in the North is hemlock and canoe birch.

Winter walks.—The cheapest and most practical winter-garden for the largest number, may be a simple walk leading to the front, back, or side door, bordered by shrubs and trees, of which half or more have winter attractions. Brick set on concrete is considered pleasanter to the eye and foot than concrete, and is drier

than grass. The tapestry type of brick set on edge is expensive, but gives a rich texture.

Materials for winter-gardening.

One hundred and twenty-eight trees and shrubs that have pronounced winter beauty were listed by John Dunbar from the Rochester parks, not including the evergreens or plants that lose their vivid color before the end of the holidays. With such a wealth of material there should be little excuse for bare and ugly surroundings. Only the classes of materials may be mentioned and exemplified here.

Broad-leaved evergreens.—These are often more expensive than the narrow-leaved evergreens, and of smaller stature, but they have more ample foliage and frequently showier flowers or fruits. All require special care. Examples are American holly, mountain laurel, *Rhododendron catawbiense* and *R. maximum*, evergreen thorn, trailing myrtle, evergreen bitter-sweet, box, and its substitute, *Ilex crenata* var. *microphylla*. The English standard of beauty is European holly, laurel, and hybrid rhododendrons, because the darkest and shiniest foliage is commonly thought to be more beautiful than the duller and yellow-green type. A more practical standard for our climate is furnished by American holly, laurel, and rhododendron. In nurseries where both classes of plants may be observed, the European kinds are unquestionably rich and aristocratic, but sound a foreign note, while the native kinds have a cheery, sunny color that is eloquent of adaptation to our climate and



3028. A good subject in the winter-garden.—Fruits of the barberry.

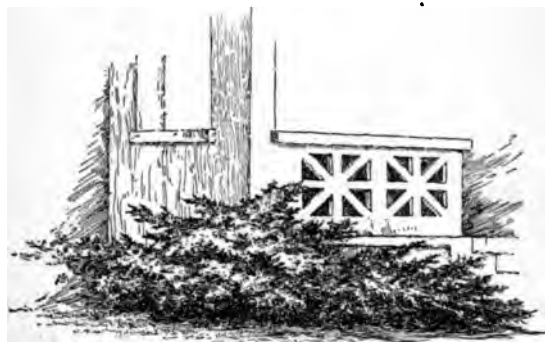
scenery. The same principle applies to the narrow-leaved evergreens, Irish yew being commonly but mistakenly preferred to Canadian or Japanese yew. Semi-evergreens, like Hall's honeysuckle, are listed in this work under *Autumn-Gardening*.

Narrow-leaved evergreens.—The European standards are Scotch and Austrian pine, Norway spruce, silver fir, Irish juniper, and Irish yew. These are climatic misfits in America and constitute the bulk of the evergreen planting east of the Rockies that proves unsatisfactory. The American standards are white pine, hemlock, Douglas spruce, concolor fir, red cedar, and Canadian yew. The types of beauty represented in the two lists are not closely comparable.

Deciduous trees and shrubs.—Though lacking in brilliant color, the following are standards of quiet beauty.

Marked for their outline or habit are pin oak, sweet gum, white birch, pepperidge, sassafras, tulip tree, white oak, and sycamore. Noted for their winter buds are flowering dogwood, beech, shagbark, balm of Gilead, honey locust, swamp bay, sassafras, and pussy willow. Familiar by their trunks are beech, birch, shagbark, sycamore, white oak, tulip tree, sweet gum, flowering dogwood, and mountain-ash.

Shrubs with brightly colored berries.—These materials do more to transform ordinary city lots than any others here mentioned. Shrubs cost less than evergreens,



3029. A graceful winter form in dwarf juniper.

mature more quickly than trees, are fairly permanent, and are cheap. Of the shrubs with decorative fruits, there are two main groups based on duration. Those which are attractive all winter, like barberries, must be reckoned more valuable than those which drop by New Year's or cease to be attractive then, like snowberry and Indian currant. Each of these groups may be divided again on a basis of color. Red is the favorite color, because it seems to give the most warmth at the time it is most needed. Consequently the most popular shrubs for winter berries are the common and Japanese barberries, the multiflora and prairie roses, and the high-bush cranberry, all of which retain their red berries until spring. Of the other red berries, *Viburnum dilatatum* lasts until April; Japanese bitter-sweet until March; *Viburnum Sargentii* until February; while the following are attractive until February: Most species of *Evonymus* and *Cotoneaster*, *Ilex verticillata*, and red chokeberry (*Aronia arbutifolia*). The red-berried species tend to produce yellow varieties, but they have less popular appeal. Blue berries of great beauty are borne by the familiar white fringe and the little known *symplocos*. Theoretically black is an unattractive color, yet practically the black fruits appear well, especially against the snow, the most familiar example being the massive cluster of California privet, while the open cluster of Regel's privet has more grace. *Viburnums* furnish many dark berries, as do the following choice plants: *Acanthopanax sessiliflorus*, *Rhamnus carthartica*, *rhodotypos*, *Phellodendron amurense*, *Rhamnus dahurica*, and *Aronia melanocarpa*. Theoretically white should be the chilliest and least attractive color in winter, yet the snowberry is probably the only bush that is planted almost wholly for its winter berries, and its popularity continues although it often loses its attractiveness before Thanksgiving. The small waxy berries of candleberry (*Myrica*) are an agreeable sight till January, but this plant is more famous for its fragrance.

Shrubs with brightly colored twigs.—These materials are even more brilliant than shrubs with brightly colored berries. The ordinary 2- to 3-foot bush of barberry has few berries, when planted in the fall, while a Siberian dogwood of the same size is a consistent mass of red from planting day in October until April. These materials are showier on sunny days than clouded ones, and look best when the sun is at one's back. They do

tolerably in the smallest yards of large and smoky cities but do not develop the brightest colors in dense shade.

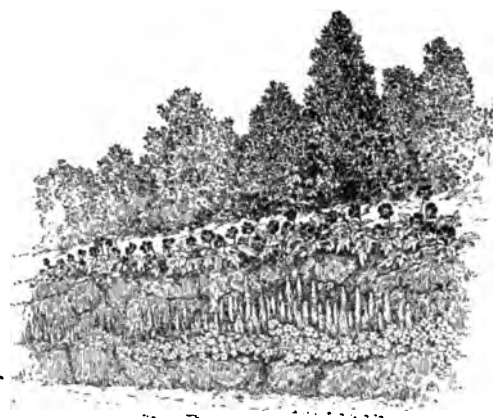
In this group, also, red is the favorite color, the most popular being Siberian dogwood, with the *Britzensis* willow a fair second, the latter being unsuitable for foundation planting. Vivid color is often confined to twigs or wood a year or two old, as in the lindens, but a four-year-old Siberian dogwood is showy from the ground up. Those who like a change from the Siberian sometimes plant the silky dogwood, which has purplish red wood, or the quieter-toned *stolonifera*, but the latter needs a moist situation and is too scaly for foundation planting. Yellow branches are more popular than yellow berries. Willows furnish half a dozen yellow kinds, dogwood two good ones, and yellow poplar one. Vivid green wood is furnished by *kerria*, *Forsythia viridissima*, *sassafras*, *Colulea arborescens*, and a variety of *Cornus sanguinea*.

Winter flowers.—The only hardy winter flower of importance is the Christmas rose (*Helleborus niger*), which blossoms in the North amid or under the snow any time from November to March. Winter crocuses are merely a coldframe hobby for enthusiasts. Scillas and the other March-blooming bulbs are often seen blooming in the snow, but they are essentially spring flowers. A unique and wonderful winter beauty is *Pieris floribunda*, which seems to be crowned by white flowers, but these are really buds. They are all the more wonderful because naked, and all the more beautiful because set off by evergreen foliage.

WILHELM MILLER.

Planting on walls. (Fig. 3030.)

Wall-gardening and walled gardens are two different departments of horticulture. The walled garden is an old English development based on the need of protecting fruit from thieves and on the fact that grapes and peaches do not ripen in the cool summers of England without extra heat, such as a south wall gathers. Out of these conditions have grown high brick and stone walls aggregating hundreds of miles in extent and forming a familiar sight in the English landscape. The walls have come to be covered with all sorts of fancy fruits trained like vines. They also shelter many subtropical shrubs trained as climbers, which otherwise could be grown only under glass. Although these walls are often crowned with broken glass or spikes, they are generally beautiful in themselves, or are made so by a clothing of vines. Moreover, earth-filled holes are often purposely left on top for the growing of rock-loving flowers, such as wallflowers, snapdragons, wall pepper, Kenilworth ivy, houseleeks, and wild pinks. Time adds the crown-



3030. Piece of a wall-garden.

ing touch of loveliness by encouraging mosses on the shady side and lichens on the sunny. This type of garden is not common in America because it is very costly to make and also to maintain, owing to the higher cost of skilled labor for training fruits. Moreover, a wall is not necessary in our own hot summer climate for the ripening of grapes and peaches. However, the walled garden will gradually increase in numbers, for several reasons: It offers better protection from thieves than hedges or shrubbery; it makes a kitchen-garden yield from one to three months longer by giving protection from cutting winds and frost; it makes a sheltered outdoor playground for children in winter; it makes an effective background for hardy perennial flowers; and it gives privacy and charm, which gardens open to every eye do not possess.

Wall-gardening, on the other hand, is a modern application, growing out of the English passion for alpine flowers and based largely upon the fact that many of these exquisite flowers perish in the hardy borders, because of the wet English winters, but flourish permanently in the chinks of a wall, where they get better drainage. This is true of wallflowers and snapdragons, which have glorified many ruins for centuries, while on the level ground they are short-lived. Thus, dry-walling became fashionable at the beginning of the twentieth century. It was customary, whenever grading operations left a bank of earth, to put in a retaining wall, avoiding cement, and laying alpine plants between the stones. The popularity of this type of garden is attested by Gertrude Jekyll's "Wall- and Water-Gardens," which has thirty-three plates illustrating the construction and main floral effects. Steps are commonly made in such a way that nearly all parts not actually needed for treading are filled with carpets and cushions of rock-loving flowers.

In America, wall-gardening was welcomed as an opportunity to replace some of the artificial, monotonous, and ill-kept grass-banks by retaining-walls clothed with the natural and varied beauty of flowers. Unfortunately, much of the most refined beauty of English wall-gardens, such as the mossy saxifrages give, is impossible here, because the hot summers are unfavorable to the choicer alpine. Analysis of the four largest and most successful examples of wall-gardening known in America in 1914 shows that great and new beauty has been achieved in this way, but that the largest floral effects are made by plants that are not particularly associated with mountains or rocks and which are easy to grow in ordinary gardens without the expense of dry-walling. Such desert plants as the houseleeks and stoncropps spread over large areas. Other successes are rock cress (*Arabis albidula*), woolly chickweed (*Cerastium tomentosum*), snow-in-summer, woodruff, wild pinks, alpine forget-me-nots, Kenilworth ivy, and veronicas. Such carpets, however, do not have the charm of the dainty rosettes and mossy cushions of the high-altitude alpine, such as saxifrages, primroses, gentians, and edelweiss.

It is possible to have some of these finer things, if one does not stuff the walls with too much earth. This practice, which seems reasonable to every beginner, encourages the plants to make roots within the walls, and such roots are naturally destroyed by the first hot weather. It is better to give them a little grit and only a pinch of earth, so as to force the plants to send long roots through the walls into the earth banks where they will find the moisture, coolness, and drainage that are demanded by high alpine.

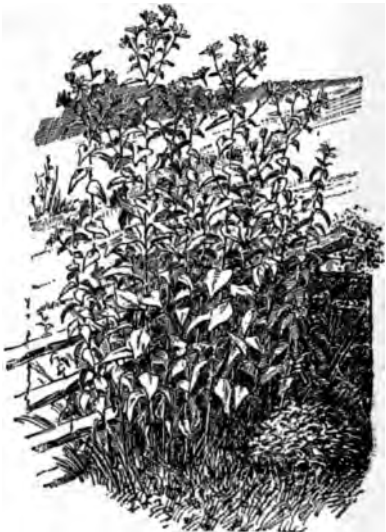
Steps have been successfully filled in America with chink-loving flowers, but most gardeners are conservative about experimenting, declaring that the colder winters of America will cause damage to stone and flowers by the heaving action of frost. It is certainly unwise to have wide spaces between stones filled with material that will expand too much, but the aim should

be to give the plants as little root-room and food as possible in order to encourage their rooting outside the stonework.

WILHELM MILLER.

Screen-planting.

From the landscape architect's point of view, screen-planting may be used to hide unsightly objects, to afford protection from prevalent winds, to give a background to the house, to lend an air of privacy and seclusion, or sometimes to add an ornamental feature. It may take the form of deep border planting, narrow hedge lines or mere vine-covered screens. Trees, shrubs, and vines are all available; but, whatever is used, the denser its habit of growth, the better screen it will make. Other things being equal, evergreens are better than deciduous plants, for the latter lose their leaves in winter. However, if evergreens are not available, there are still many deciduous plants whose dense habit of growth make a good screen even after the leaves are gone. A border planting, as in Fig. 2999, is really a screen against objects beyond; so also are such cover-plantings as those in Figs. 3000, 3001, 3031 and others. The real screens, however, are those plantings made for this particular purpose, mostly narrow in form but dense.



3031. A screen subject in a corner.

Vines for screen-planting.

For brick, stone, tree-trunks, or other solid surfaces.

Deciduous:

Hydrangea petiolaris (climbs by root-like holdfasts).

Parthenocissus quinquefolia var. *Engelmannii*. A variety of Virginia creeper with disks, or suckers, on the ends of the tendrils, which enable the plant to fasten itself to a surface.

Parthenocissus tricuspidata var. *Veitchii*.

Evergreen:

Evonymus radicans var. *vegeta* (climbs by root-like holdfasts).

Hedera helix. Somewhat tender; in the N. should be planted where it will be shaded from winter sun or at least have its roots thoroughly mulched and the ground shaded by low growth about its base; climbs by root-like holdfasts.

Rapid-growing vines for banks or unsightly objects.

Annuals:

Boussingaultia baselloides. Twining tender perennial treated as an annual, growing from 10 to 15 feet a season; roots must be taken up and stored away from frost.

Calonyction aculeatum (twining).

Echinocystis lobata (self-seeding; tendrils).

Humulus japonicus (twining).

Ipomoea purpurea (twining).

Phaseolus multiflorus (tendrils).

Herbaceous perennials (dying down to the ground but springing up again from the root):

Ipomoea pandurata (twining). This and next have fleshy roots and may become a nuisance if allowed to spread.

Pueraria hirsuta. This is known also in commerce as *Dolichos japonicus*; grows 40 feet in a season; twining.

Woody perennials (woody stem persisting above ground):

Actinidia arguta (twining).

Aristolochia macrophylla (A. Siphon) (twining).

Celastrus scandens (twining).

Lonicera japonica var. *Halliana* (twining).

Lycium chinense and *L. halimifolium*. Both are shrubs with recurring trailing stems which do not twine. Plant must be fastened to its support. Excellent to hold banks, but very vigorous and may become a nuisance.

Tall-growing vines reaching eaves of the house.

Actinidia arguta (vigorous; dark glossy foliage, twining).
Aristolochia macrophylla. Twining; large heavy foliage; should not be used unless dense shade is desired.
Campsis radicans. This is a heavy vine climbing by root-like holdfasts which are too weak to hold it in storm or wind; must be fastened to its support. Somewhat tender in the N. and usually has more or less dead wood. Better when used as porch or pillar vine where it can be reached and pruned easily.
Celastrus scandens (twining).
 Parthenocissus. All kinds; tendrils with or without disks.
Wisteria chinensis. The finest of tall-growing vines; vigorous and hardy at all times.

Vines for foliage only. All in the following list are deciduous, i. e., drop their leaves in winter. The only evergreen vines which can be used in the North are *Evonymus radicans* and *Hedera helix*. Even the foliage of *Evonymus radicans* will occasionally burn in winter although it is harder than English ivy in this respect. *Vinca minor* and *Pachysandra terminalis* are good creeping plants for evergreen ground-cover and Hall's honey-suckle is semi-evergreen, holding good foliage until Christmas. Other flowering vines also good in foliage are *Clematis paniculata*, *Forsythia suspensa*, which is a shrub with recurving and trailing stems excellent for running over a bank or hanging down a wall, *Rosa Wichuraiana* and some of its many hybrids, and *Wisteria chinensis*.

Actinidia arguta.
Akebia quinata. Very graceful vine with delicate five-parted foliage, semi-evergreen, remaining until January; twining.
Aristolochia macrophylla.
Celastrus scandens (berries red and orange all winter; twining).
Lycium halimifolium.
Parthenocissus quinquefolia. Beautiful red autumn color; first vine to color in the fall; climbs by tendrils usually without disks except in var. *Engelmannii*.
Parthenocissus tricuspidata var. *Veitchii* (beautiful autumn color; climbs by tendrils ending in disks).
Smilax rotundifolia. A vigorous wild vine with thick glossy foliage enduring both shade and wet soil.
Vitis Coignetia. From Japan; a vigorous grower with immense leathery leaves usually brown felt beneath; the foliage is especially strong and bold and turns a rich red color in fall.

Vines for flower. Plants marked with an asterisk (*) have attractive foliage as well as bloom.

Campsis radicans. A heavy vine.
Clematis Jackmanii. Climbs by twisting leaf-stems. Flowers large and purple. *C. Jackmanii* var. *alba* is similar, but the flowers are creamy white. Both of these are good vines for bloom in July and August.
 **Clematis paniculata*. Climbs as does the preceding species. Flowers small and white, covering plant with a mass of bloom in September and October. Foliage remains glossy green, good until December. The best fall-blooming vine.
 **Forsythia suspensa*. Flowers yellow, appearing before the leaves covering the plant with a mass of bloom in April. Flower-buds often killed by cold in the northern tier of states.
Lonicera Heckrottii. Climbs by twining. This is a hybrid which blooms continuously during July, August, and September. The flowers are rose outside and yellow inside, and as open and closed flowers are present at the same time they make a very handsome showing. The only objection to the plant is that it is badly infested with aphids or green-flies.
 **Lonicera japonica* var. *Halliana*. Bloom profuse and fragrant; flowers white, fading yellow in June and July.
 Rambler roses, in order of bloom, June and July. These must be tied up, but are hardy without protection except possibly in the northern tier of states. In such cold places one must be content with the upright shrubby *Rosa rugosa* in white, and red varieties, both single and double, beginning in early June; with the white *Rosa multiflora*, beginning from middle to late June; and with the pink *Prairie*, or *Michigan*, rose (*Rosa setigera*) which does not begin until the second week in July. *R. multiflora* and *R. setigera* are both shrubs with an arching habit and have produced many Rambler roses. Of the varieties following, those marked with a dagger (†) are the best: †*Fausendachön*, middle June, double, delicate pink, larger than *Dorothy Perkins*; *Lady Duncan*, single, rich salmon-pink; †*Excelsa*, late June, or early July, a long-season rose, double, rich crimson, a new variety, blooming at the same season as the old *Crimson Rambler*, but a better color; *Dorothy Perkins*, early July, double pink; white *Dorothy Perkins*, a white variety of the preceding; *Alberic Barbier*, middle July, semi-double or double creamy white, yellow in center, dark yellow in bud, excellent glossy foliage; *Aviator Blieriot* is a new variety, very similar to *Alberic Barbier*; †*Hiawatha*, middle July, a long-season rose, single, bright red with white center and yellow stamens; **Mrs. H. M. Walsh*, middle July, double, white, same long season and good foliage as *Rosa Wichuraiana*, the *Memorial* rose of which it is practically a

double form; †*R. Wichuraiana*, which is blooming at this time, is the parent of many of the varieties named above, and is itself a very attractive rose.
 **Wisteria chinensis*. A strong, twining vine, with long, hanging clusters of white or purple flowers, according to variety, in middle and late May. Leaves alternate, compound, large, loose, and feathery. Beautiful in flower, graceful in habit, satisfactory in foliage, and vigorous and hardy at all times.

Large trees for wind protection and for background setting to the house.

Deciduous: These deciduous types are dense and compact in habit and make a good screen or background even after the leaves are gone in winter.

Acer platanoides.
Acer saccharum.
Æsculus Hippocastanum.
Fagus sylvatica.
Quercus alba.
Tilia europæa.

Evergreen: The Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea excelsa*), and Colorado blue spruce (*Picea pungens*) are probably the three most commonly planted evergreen trees. The Scotch pine is the best of the three for neutral mass planting but none is so satisfactory as the hemlock or the pines listed below. The Scotch pine has an irregular spreading habit with bluish green foliage, salmon-colored limbs and trunk and picturesque habit when old. It grows rapidly but is short-lived in America. The Norway spruce and Colorado blue spruce are both conical evergreens and for this reason alone they are always emphatic and conspicuous. Even when planted in mass the individuals are so distinct that it requires years for them to merge into a uniform solid mass. Comparing a solid planting of Norway spruce with a similar planting of hemlock, it is seen that in the former every individual spruce is stiff and conical and remains so for years, while the hemlocks with their graceful form and habit have lost their individuality and merged into one indefinite mass. The Norway spruce is also too somber and funeral for cheerful home-ground planting. It is also short-lived in America and while hardy and rapid-growing it begins to go back and die at the top after forty or fifty years except in very favorable locations. The Colorado blue spruce is also short-lived in the eastern states and is altogether too conspicuous and emphatic both in form and color for neutral background planting.

Pinus austriaca.
Pinus resinosa.
Pinus Strobus.
Pseudotsuga taxifolia. This is a large conical tree like Norway spruce and therefore not so good for neutral background planting as either the pines or the hemlock mentioned in this same list. But it is the best of the conical spruce or fir type because more graceful in habit, with soft more flexible foliage which is green or gray-green in color. It is a vigorous grower and though little known it is a very promising evergreen tree. Only the Rocky Mountain form is hardy in the East.
Tsuga canadensis, the common hemlock.

Rapid-growing trees for screens. As a class, the rapid-growing trees are weak-wooded and transient. They are cheap and are usually thought of as fillers for temporary or quick effects until more permanent trees can be established.

Deciduous:
Acer Negundo.
Acer saccharinum.
Populus, *Carolina poplar*.

Evergreen:
Picea excelsa.
Pinus sylvestris. These are probably the fastest growing evergreen trees but they are not so long-lived as white pine, nor do they make either as graceful or as effective screen.

Screens tall and narrow (10 to 15 feet). Space the plants 2-3 feet apart in single row. For taller and more rapid-growing material, use Lombardy poplar (*Populus nigra* var. *italica*), or upright sugar maple (*Acer saccharum* var. *monumentale*), 6 feet apart in the row. This latter is a new and very desirable form. It is durable and slower-growing like the sugar maple but narrow and upright like the Lombardy poplar. Bolle's poplar (*Populus alba* var. *pyramidalis*) is a narrow upright form of the European white poplar and is just as undesirable as that tree. Moreover, the white woolly coating on the under side of the leaves makes the tree very conspicuous and when pronounced color is thus added to narrow upright form the tree becomes too emphatic for ordinary use. The Lombardy poplar with its normal green foliage is much safer to use when either vertical emphasis or a tall narrow screen is needed.

Deciduous:

Carpinus Betulus var. *globosa*. This is a compact upright variety of the European hornbeam. Excellent hedge-plant but very slow-growing. A plant standing in the open at Arnold Arboretum, Boston, has grown 6 feet wide and 12 feet high in 25 years. Perfectly hardy and, like *Berberis Thunbergii*, so dense that it makes a definite screen even after the leaves have fallen.

Quercus pedunculata var. *fastigiata compacta* (a compact upright form of the English oak).

Evergreen:

Chamaecyparis nootkatensis. This is little known in the East as yet but has all the requirements for an ideal hedge-plant, tall and narrow. Plants observed in the open at Ithaca, New York, are perfectly hardy and have grown 6 feet wide and 7 feet high in twelve years. They have not been protected nor trimmed nor specially cared for in any way. They are upright and oval in shape and very dense and compact. The foliage is thick and soft to the touch.

Juniperus chinensis. Resembles the native red cedar, *J. virginiana*, but is better because the foliage does not brown in winter. Also the leaves are more spreading and their bluish gray upper surfaces more noticeable which gives the spray a fuller and lighter-colored appearance.

Juniperus communis var. *hibernica*. This should be trained in the nursery to one central stem. When young the Irish juniper is a handsome narrow upright plant with bright gray-green foliage; but it grows much more rapidly than other cedars and soon looks miserable because, as now grown, its more or less equal upright parts become too heavy to support themselves and spread apart destroying the symmetry of the plant as well as revealing the dead and unsightly inner foliage.

Juniperus virginiana.

Taxus baccata var. *hibernica* (not quite hardy above N. Y. City).

Thuja occidentalis var. *pyramidalis*.

Thuja orientalis. This resembles the native *arborescens* but is more handsome. Its branches and branchlets are also more distinctly vertical and the foliage smaller and brighter green.

Shrubs for screen border-planting.

Small (2 to 4 feet) (other native plants not so dense in habit but with good foliage will make very effective screen-planting when massed together):

Deciduous:

Berberis Thunbergii (occasionally 6 feet).

Catalpa Bungei. This is the trade name for *C. bignonioides* var. *nana*. It is simply a dwarf variety of the southern catalpa and makes a dense round bush when growing on its own roots. It is often grafted high on upright stem and planted as a substitute for bay trees.

Chamaelea japonica.

Deutzia gracilis (2 to 3 feet).

Deutzia Lemoinei (3 to 4 feet).

Dirca palustris. This has thornless flexible leathery twigs but is dense and symmetrical like *Berberis Thunbergii*. If allowed to grow naturally it will make good low hedge.

Hypericum aureum.

Hypericum prolificum.

Kerria japonica.

Ligustrum Iboia var. *Regelianum*.

Ligustrum ovalifolium. This is not hardy north of Philadelphia and can be used only for low hedge in the North. May be cut to the ground and will spring up vigorously every year.

Lonicera thibetica.

Lycium chinense.

Lycium halimifolium.

Philadelphus coronarius var. *nanus* (2 to 3 feet).

Philadelphus Lemoinei (in variety, especially var. *Avalanche*).

Candelabre, and *Gerbe de Neige*.

Philadelphus microphyllus (this and *P. coronarius* are the original parents of the *Lemoinei* hybrids).

Rhus canadensis.

Rosa rugosa (often 5 or 6 feet high but better if kept low and vigorous by frequent renewal from the base).

Rosa rugosa var. *Blanche de Coubert* (beautiful semi-double, white).

Rosa spinosissima var. *altaica* (often 5 feet).

Spiraea Bumalda, Anthony Waterer variety (2 feet).

Spiraea japonica (3 feet).

Spiraea Thunbergii.

Spiraea trilobata.

Symphoricarpos albus (often 5 feet).

Symphoricarpos orbiculatus (2 to 3 feet).

Vaccinium corymbosum (often 5 to 6 feet).

Viburnum Opulus var. *natum* (2 to 3 feet. Seldom has flowers).

Evergreen:

Buxus japonica. A new and hardy box; will probably reach 8 feet, but is slow-growing and easily restrained by clipping.

Buxus sempervirens. Must be protected in the North but is hardy and tree-like in the South.

Chamaecyparis obtusa var. *nana* (6 to 8 feet, but very slow-growing and easily restrained).

Evonymus radicans var. *vegeta* (2 to 3 feet; with a little clipping can be brought into a low natural hedge mass).

Ilex glabra.

Picea excelsa var. *Clanbrasiliana*.

Pieris floribunda (2 to 3 feet).

Pinus densiflora var. *pumila* (often 6 feet).

Pinus montana var. *Mughus* (often 5 to 6 feet).

Rhododendron, *Boule de Neige* (white, blooming-period early).

Rhododendron carolinianum. Color lavender-pink, blooming-period very early. See note on page 2692.

Taxus cuspidata var. *brevifolia*.

Thuja occidentalis var. *nana*. This may reach 3 to 4 feet but is very slow-growing and easily restrained by clipping.

Thuja orientalis var. *nana*. This may reach 3 to 4 feet but is very slow-growing and is easily restrained by clipping.

Medium (6 to 8 feet) (other native plants not so dense in habit but with good foliage will make very effective screen-planting when massed together):

Deciduous:

Acanthopanax pentaphyllum.

Acer palmatum (often larger but slow-growing).

Berberis vulgaris.

Cornus paniculata.

Evonymus alata.

Forsythia suspensa. Good definite form and best for individual specimen planting.

Ilex verticillata.

Lonicera fragrantissima.

Lonicera Morrowii.

Myrica carolinensis. Sometimes much larger than 6-8 ft. Can be kept lower very easily by thinning out and renewing from the base. Is still known in commerce as *M. cerifera*. Ranges north to Nova Scotia near the coast. Is more shrubby, with blunt leaves which are broader and more oblong than those of *M. cerifera*.

Philadelphus inodorus. Has more definite and graceful form than *P. coronarius* and dark green almost glossy foliage.

Rhodotypos kerrioides.

Spiraea bracteata.

Spiraea gemmata.

Spiraea prunifolia var. *flore-pleno*.

Spiraea Vanhouttei.

Evergreen:

Ilex crenata.

Kalmia latifolia (sometimes higher than 6 to 8 feet).

Picea orientalis. Large tree but adapted to small-scale planting because very slow-growing and also because easily restrained by pruning or pinching back.

Rhododendron, *Caractacus* (color bright red, blooming-period medium).

Rhododendron catawbiense var. *album*. Compact habit of *R. catawbiense* but flowers white, blooming-period early.

Rhododendron delicatissimum (color bluish-white, blooming-period late).

Rhododendron Everestianum (color lavender, blooming-period early).

Rhododendron, H. W. Sargent (color dark red, blooming-period late).

Rhododendron, Lady Armstrong (color pink, blooming-period early to medium).

Rhododendron purpureum elegans (color purple, blooming-period medium).

Taxus cuspidata.

Tsuga canadensis. The most graceful and effective large evergreen for screen-planting. Takes up less room than white pine and is much slower-growing. Can be restrained easily and therefore is adapted to small-scale planting.

Large (10 to 15 feet) (other native plants not so dense in habit but with good foliage will make very effective screen-planting when massed together):

Deciduous:

Acer campestre (small compact tree, dense foliage).

Acer ginnala (gorgeous autumn color).

Acer platanoides var. *globosum* (dwarf, dense, slow-growing).

Bensoin aestivale.

Berberis aristata.

Carpinus Betulus. Much used for hedges. Better than our native hornbeam, *Carpinus caroliniana*.

Cornus mas (small compact tree, 15 to 20 feet).

Cotinus Coggyria.

Crataegus coccinea.

Crataegus Crus-galli.

Crataegus Oxyacantha var. *Paulii*.

Crataegus punctata. All these thorns are better as natural screens with room to spread at the bottom than when confined in restricted hedge lines.

Hibiscus syriacus. Ten feet, dense and compact making good tall hedge, but thin at bottom. Plant low dense shrubs in front. The white variety is the best.

Laburnum alpinum (compact large shrub or small tree 20 to 30 feet high).

Ligustrum Iboia.

Ligustrum vulgare.

Lonicera tatarica.

Philadelphus coronarius.

Pyrus coronaria (small tree).

Pyrus pulcherrima (small tree).

Rhamnus cathartica.

Rhamnus Frangula.

Syringa chinensis var. *alba*.

Syringa chinensis var. *Sougeana* (var. *rubra*).

Syringa vulgaris.

Viburnum dentatum. Will reach 10 to 12 feet, but may be restrained easily by gradual renewal from the base.

Viburnum Lantana.

Viburnum prunifolium (small tree).

Evergreen:

Ilex opaca.

Pinus montana a low, bushy tree, 20 feet high and 20 feet broad; very slow-growing.

Pinus Strobus. Excellent for screen-planting. More graceful, effective, and permanent than Norway spruce or Scotch pine.

Pseudotsuga taxifolia.

Rhododendron album elegans (color white, blooming-period medium).

Tsuga canadensis. The most graceful and effective large evergreen for screen-planting. Takes up less room than white pine and is much slower-growing. Can be restrained easily and therefore is adapted to small-scale planting.

RALPH W. CURTIS.

Winter protection of planting.

Winter protection is the preparing of plants to withstand the winter (Figs. 3032-3047). All plants are usually hardy in their own habitat, but many become tender when removed to a colder climate, requiring artificial protection. A permanent covering of snow furnishes ideal protection, but unfortunately the American winters are very changeable. Continued steady cold is seldom injurious, but the alternate freezing and thawing



3032. Straw overcoats for roses.

toward spring are often fatal, the damage varying according as the situation is wet or dry and the soil light or heavy. For example, shallow-rooted plants, as *Lobelia cardinalis*, will often be thrown out of the ground in clayey soil. Such damage may be prevented by placing sods over the plants. Gailardias will winter safely in light well-drained

soils with ordinary protection, but perish if wet and heavy. The remarks in this article are meant to apply in the vicinity of Chicago. Winter-covering intercepts the sun's rays and retards premature activity. It is as essential "to keep in the cold" during temporary warm spells as it is to retard excessive depth of frost. More damage is generally done in February and March than earlier. Roses and other shrubs may be prepared for the winter any time from the last half of November until well into December, but any plants of an herbaceous nature may be covered much earlier. Where field-mice are troublesome it is well to defer covering until after a good freeze, so that these nibblers may seek other winter quarters. Rabbits are fond of the Japan quince, *Spiraea Vanhouttei*, *Evonymus alata*, and some others, and often damage newly planted material the first winter. When the branches are beyond their reach, protect the trunk with straw, tar paper, or burlaps, which will also prevent sun-blistering. If the shrubs are in groups or low-branched, run wire netting around them. Fall-planted material should be better protected against frost than established plants of the same species. All the Japanese flowering forms of the plum, peach, and cherry tribes should have their roots mulched 4 or more inches deep. The fatal damage in the winter of 1898-1899 was at the roots, not overhead. Figs. 3032, 3033 show protection by means of straw and boughs; Figs. 3034-3036, protection inside of boxes, barrels, and wire netting.

Plants with evergreen foliage, like *Heuchera sanguinea*, are safer with a covering that will not mat down and rot the foliage or injure the crown. The danger is in open, wet seasons. Forest leaves are excellent for winter covering, provided they do not mat down. Oak

leaves are good, but those of elm, maple, and other trees that shed their foliage early are soft and mat too much. Leaves may be held in place by evergreen boughs, brush, or tops of bushy perennials like the native asters, or coarse strawy material. When leaves are used in barrels or boxes, the top of the package should be water-tight, and the leaves dry when put in.

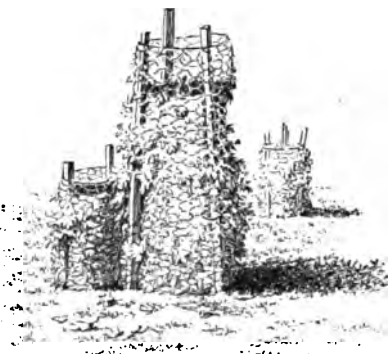
This precaution is not essential in all cases, but it is a safe rule to follow. Tar paper is comparatively cheap and comes handy in many phases of winter-covering. Gather the leaves when they are dry, and store under shelter until wanted. Save vines like those of *Clematis*

paniculata and pole limas; they are good for covering climbing roses that are almost hardy. These keep off the bright sun when the plants are in a semi-frozen condition, shield them from the drying winds, and retard premature starting of the flower-buds. *Forsythia suspensa* trained as a climber on a south wall is benefited by such covering, or by burlaps, as its sheltered position induces activity too early and its flowering buds become a victim to late frosts. Any rhizomatous iris, such as the German iris, should be planted where surface drainage is ample, and in the case of young plants, or those recently divided, not covered with heavy manure or they are likely to decay in wet weather. Cover such plants with light material. Old established plants seldom need protection. *Chrysanthemum coccineum* requires similar conditions and treatment. All lilies except the hardiest, such as *L. tigrinum*, *L. elegans*, *L. canadense*, *L. superbum*, *L. philadelphicum*, *L. speciosum*, *L. tenuifolium*, and so on, are best covered by a mound of ashes—wood or coal—which retains an even temperature. The other lilies may be mulched with manure and *L. candidum* with leaves. *Eremurus* in all its species, and *Alstræmeria aurantiaca*, require a deep box of leaves and the surrounding soil well mulched. An inverted V-shaped trough placed over such low edging plants as

Veronica circaoides and *Thymus Serpyllum* var. *montanus*, is beneficial. It is well to take up a few plants of *Monarda didyma*, the double perennial sunflower, and *Thymus Serpyllum*, and winter them in a frame, over which place a wooden shutter to shed rain, placing leaves or manure on those that remain

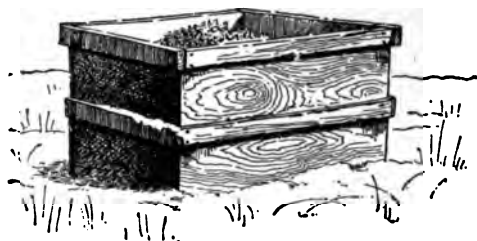


3033. A tender tree bound in branches of hemlock. The protected tree is a specimen of *gordonia* about 10 feet high, at Arnold Arboretum, Boston.



3034. One way of protecting young rhododendrons. The space inside the wire netting is filled with autumn leaves.

Where permanent windbreaks, such as plantations of evergreens, buildings or solid fences, do not exist, temporary ones should be made of boards, evergreen boughs, corn-stalks, and the like, to protect arboreal plants that are not quite hardy, e. g., in this climate *Halesia carolina*, and in the eastern states *Magnolia grandiflora*, hollies, and the like. Place the windbreak at the sides toward the prevailing winds, generally



3035. Protecting plants by covering with a box inside which are placed leaves or straw.

north and west, and at the sunny side of any evergreen that browns. The boughs or stalks may be attached to wire netting or to cords fastened to stakes.

The so-called retinisporas may have placed over them an empty box open at the top. Shrubs that are still more tender should be boxed, the box having a tight top and ventilation at the sides. In all cases mulch well at the roots. *Magnolia Soulangeana*, *M. speciosa*, and plants of similar degrees of hardiness may have their branches tied in and empty casks placed over them, one sitting partially inside the other, and held in place by stakes. Put a cone-shaped covering over the top to shed the snow. Or poles may be set close to the tree, wigwam fashion. Wrap these with burlaps, or wind string around them for the straw to lean against, and in both instances wrap with straw.

The so-called hardy climbing roses, such as the Seven Sisters and Prairie Queen, which are hardy without protection, but are benefited by it, Wichuraiana and its hybrids, Paul Carmine Pillar, Russell Cottage, Crimson Rambler, Thalia, and Lord Penzance Sweetbrier hybrids, if against a wall, may have clematis or other vines placed thickly over them; or if in an open exposed situation, they may be wrapped in straw. (Fig. 3033.) Better still, hill up the soil rather high at the roots,—to prevent breaking and to afford protection and drainage,—and then take the trouble to extend the mound in the form of a gradually diminishing ridge. Bend the canes along the ridge, choosing a time when there is no frost in them; then cover the canes with tar paper, over which place soil, strawy manure, or any warm covering. If the presence of a lawn prevents this method, lay on the grass and cover with a water-tight box filled with leaves. Canes will rot directly under an open knothole. In the spring allow them to remain prostrate some time after uncovering to inure them gradually to the change and to induce the lower buds to strengthen. Hybrid Perpetuals, the tender forms of Moss roses, Hermosa, Clothilde Sou-pert, and the Dwarf Polyanthas, may be wrapped, boxed, or bent over and covered with soil. Those in beds may be bent over, the tops tied to the



3036. Plants protected in a barrel covered with burlaps.

base of their neighbors, lead tags bearing numbers fastened to each plant, and a record taken of their names, and all summer labels stored to prevent loss when removing the leaves in the spring. Make a solid frame around them, higher at one end, and fill with leaves so as to cover the plants. Lap the roof-boards; they will shed water and allow ventilation. In the spring remove the leaves, replace the top for a few days, but let the sides remain for a week or so to shield from cold winds. Keep the plants prostrate until cut back.

The tender Hybrid Teas require special attention. Cultivation and watering should be discontinued in September in order to retard a late growth, but if the fall is a dry one, they should receive a thorough soaking late in October. Early in November hill up the soil around the plants to a height of 6 to 8 inches. After there is a crust of frozen soil a few inches thick, fill up with dry leaves to a little over the height of the hills or higher. Then board up the bed some 2½ feet high at one side and 2 feet at the other, and cover top with boards or tar paper, the object being to keep the leaves dry. Hybrid Perpetuals, or in fact any semi-hardy rose of low growth, may be protected as above. In most winters the Hybrid Teas can be safely carried over by hilling up the soil as described and covering with hardwood leaves 18 to 24 inches deep, held down by evergreen boughs, brush, or corn-stalks.

Field-mice or the smaller moles are troublesome sometimes where any open or loose material like leaves or straw is used for winter protection. Plants in cold-frames are often destroyed. This may be prevented by the following method: Procure some poisoned wheat and place in the interior of a 4- or 5-inch common



3037. Deep pit built like a coldframe, for carrying half-hardy woody plants over winter.

drain-tile. Place these tiles in the frames or among the roses, using ten grains of wheat to a tile. When spring comes lift up the tile carefully, so as not to spill the wheat and count the grains; by the use of the tiles one keeps track of the wheat and does not endanger the birds.

Tree peonies and yuccas should have an empty box placed over them, large enough to prevent the plant from touching the wood. *Hibiscus syriacus*, diervillas, deutzias—except *D. Lemoinei* and *D. parviflora* which are hardy—*Itea virginica*, *Cornus mas*, and the like, are wrapped in straw, and when the wrappings exceed 4 feet in height they should be staked to prevent high winds from toppling them over. Rhododendrons when planted out are taken up, the roots given a good soaking in a tub, and replanted in cold pits, or in boxes placed in a coldhouse or pits. In the spring, another bath is

given them and the soil firmly pounded around them before replanting. This is essential for continued vigor. Cut all vines of the clematis to within 1 or 2 feet of the ground and lay them down, first mounding the soil a few inches if surface drainage is not good and cover with ashes, boxed leaves, or soil, or mulch well and wrap the canes with straw. If close to a porch or steps, do not let the swept snow stay over them, unless well protected, as this snow solidifies and excludes air. If, as some now think, the broken outer skin of the hybrid forms subjects them to disease, then these varieties should not be bent over, but staked and wrapped. It is



3038. An outside cellar, in which to store roots and tubers, and pots of resting plants.

best not to cut the foliage of the eulalias or the Japan iris, as it, of itself, is a good protection, but manure at the base is essential. Cut down *Arundo Donax*, cover heavily with any material, and cover all with tar paper or water-tight shutters. Place half-rotted leaf-mold over fern-beds, narcissi, English and Spanish iris or any early-blooming bulbous plant, or a light strawy covering that is easily removed. Fine old manure a few inches thick is good and can remain. Place a good coating of stable manure around the trees on the lawn, and when they have been established any length of time bear in mind that the feeding-roots extend out as far as the branches do. The soil under them has a double duty to perform—to sustain both the tree and the grass.

Place short stakes around groups of platycodons, *Asclepias tuberosa*, or any other plants that are late to appear in the spring. Otherwise they may be overlooked in the spring and injured by digging. Examine all labels and see that none is cutting into the limbs of trees. Replace all rotten or defaced ones in the borders, using heavy labels, as thin ones often break off and are carried away when the surplus manure is removed. Cypress is a good material for labels. A good label for young trees and shrubs is made of a thin sheet of copper. The name is written with a stylus and a thin white paint rubbed on so as to fill in the depression. The label is fastened to a copper wire ring 3 or 4 inches in diameter, placed around the trunk and allowed to lie on the ground. Such a label is durable, unobtrusive and requires no attention for fear of cutting the wood, nor can it be lost.

W. C. EGAN.

Structures for the winter protection of plants.

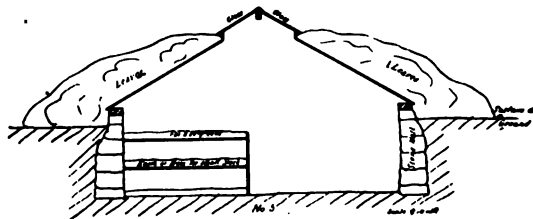
Pits, cold pits, storage-pits and plant-cellars (Figs. 3038–3047) are structures, with the greater part sunk beneath the surface of the ground, built for the purpose of protecting plants in winter without continued fire-heat. They are employed almost exclusively for storing dormant plants. They are not suitable for storing growing plants any length of time, neither are they houses in which to grow plants. They should face the

south and be sheltered against north winds by buildings or other windbreaks. Owing to their position they should be put in well-drained ground only and well protected against surface water. A well-designed frame-yard is the best possible place for small pits.

The coldframe used by market-gardeners for wintering cabbage and lettuce for spring plantings, or by the florists for pansies, primroses, forget-me-nots, and the like, is really a simple pit. Such shallow pits, with proper protection, are useful for many other small plants which would be injured by severe weather. A deep pit, like a coldframe, is shown in Fig. 3037. A pit built on the plan of the old-fashioned "outside cellar" (Fig. 3038) is useful for storing tubers and roots. See that it is well ventilated. A section of another pit is shown in Fig. 3039. More elaborate pits, for accommodating large plants, are illustrated in Figs. 3040–3047.

Double glazed hotbed sashes are now used and can be employed for the pits shown in Figs. 3043–3046, or wherever winter protection is required, as it takes too much time to cover the ordinary sash with mats and shutters. These sashes cost a little more and they are heavier; it may be well to employ, therefore, a method for ventilation which obviates the necessity of lifting. They lessen the labor and let in sunlight all day. A thin layer of air is shut in by glass; the depth of this layer is the thickness of the sash bar; it keeps in heat and so keeps out frost. It is possible that some dust and perhaps fungous growth may accumulate or form within the layers. The glazing can be done at home, the lower glass being put in without putty and held in grooves on sides and ends and on the sash-bars by thin strips of wood.

For forms of pits, consult Figs. 3043–3046. Figs. 3043–3045 show inexpensive and convenient pits for small and medium-sized plants. They may be built 4 feet or less below the level of the ground, the height and width as shown in the diagrams; the length should be some multiple of 3, any thing between 9 and 30 feet, so that the glass roof may be made of hotbed sash and also protected by the straw mats and wooden shutters in common use. See *Hotbeds*. These pits are useful for storage in winter and also for carrying some of the hardier greenhouse plants in autumn until the houses are relieved of the chrysanthemum crop. Figs. 3043, 3044 make light hotbeds in spring, if filled with the leaves which formed their winter protection, and are also available for growing such plants as euphorbia during the summer. They are generally too deep for dung hotbeds. These pits are planned to run east and west. If Fig. 3045 is thus placed, the roof on the north side may be made of plank instead of glass, but if it runs



3039. Nurseryman's cold pit. A cheap device for wintering plants that require comparatively little light.

north and south it should have a glass roof on both sides. Easy access to all is obtained through the roof by removing a sash. Sometimes a door can be built at one end. Fig. 3043 does not cost much more than Fig. 3044, and furnishes more room. By putting a few doors in the board roof, excellent ventilation and access is provided. Fig. 3045 gives the best head-room, but is rather dark for evergreens with soft foliage, e.g., *Cytisus canariensis*, unless the whole roof is glass. A

pit like this has always been used in the Arnold Arboretum for wintering seedlings, rooted cuttings and grafts,—young stock grown in flats but too delicate for the open ground. The arrangement of shelves shown in the diagram gives storage to large numbers of these small plants.



3040. A durable storing pit or cellar for very large plants.

In Fig. 3046 is shown a small plant-cellar, more expensive but with better capacity for large plants. It should run north and south, and, excepting the glass roof, is wholly below ground, and consequently extremely well protected against frost. The door is at either end or side. By taking advantage of sloping ground it is possible to enter on the ground-floor level, which is important when large plants in tubs must be handled. In such cases a concrete floor may be built. The monitor roof provides plenty of light and ventilation; wooden shutters cover the glass in cold weather. This form of pit is not only well adapted to plants, but also is excellent for storing fruits and also brussels sprouts, celery, and cauliflower until Christmas. The forms of buildings larger than those above described vary much with different circumstances. Sometimes the cellar of a stable, tool-house, or other outbuilding can be utilized. The chief consideration is protection against frost, but provision must be made for thorough ventilation, and against a too high temperature in the autumn and early spring. It is because it is hardly possible to provide for these matters that dwelling-house cellars do not make good pits; they cannot be sufficiently ventilated to keep the temperature low enough except in the middle of winter. Growth is incited and cannot be maintained owing to lack of light.

Owing to their position, pits cannot well be made of wood, plank and cedar posts lasting from 4 to 6 years only. For large pits, stone and brick are most economical for walls and ceilings; for small ones concrete probably makes the cheapest and best wall; hollow tile might be used. At the Bussey Institution the concrete walls of several small pits have stood 15 to 20 years without showing any sign of deterioration.

An excavation of the required dimensions is made, with due allowance for the walls. Inside the excavation a plank molding-frame is built at the proper distance; viz., the thickness of the walls, from the walls of earth which should have been cut as true as possible. This frame, which should also be true and plumb, is carried to the required height for the inside face of wall and another frame is made at the proper distance on the surface of the ground, the inner face of which will be the outside face of the completed wall. These frames must be well braced; they carry a heavy load until the cement hardens. It is not necessary to make a complete frame for the whole pit at once; one end and a half of both sides can be built first, and the same frame reversed will serve for the remainder. Use a good quality

portland cement mixed one part of cement to two of sand with four or five parts broken stone or gravel which should not be larger than an egg; for floors the broken stone or gravel may be increased to seven or eight parts. The whole should be completely and quite carefully blended with hoe or shovel until each stone is coated. Throw this mass into the space between the molding-frame and earth wall and settle compactly with a rammer. It is not advisable to mix more than a barrel at once, nor so much as this unless at least six men are employed. Continuous batches are made until the work is finished. When the top layers are going in, insert $\frac{3}{4}$ -inch iron bolts 6 to 8 inches long at intervals of 6 feet. These secure the wooden sills. In warm dry weather the frames can be removed within twenty-four hours or less, but first examine carefully the condition of the concrete. After removal, smooth off any roughness and grout in with a whitewash brush a coat of portland cement mixed with water, but without sand, thus obtaining a good color and a more homogeneous surface. For several days the work should be shaded and occasionally sprinkled with the hose. Do not attach the woodwork until the concrete is fully hardened. One and one-half barrels of cement make about 1 cubic yard of concrete, that costs, in place, between five and six dollars, somewhat less if the cost of labor, sand, and gravel is moderate. Build in June or July, so that the concrete will be thoroughly dry before frost.

The construction of a brick roof is shown in Fig. 3046. Concrete could also be used. A good grade hotbed sash make the best glass roof. All sills, cross-bars, and the like, should be made of cypress and painted. The woodwork must be made strong to endure the continual exposures. It is false economy to stint in quantity or quality. In cellars for nursery stock, a comparatively small amount of light is required, and the low roof is boarded in and shingled, building-paper being used. Planks may be substituted for boards, or the roof may be double.

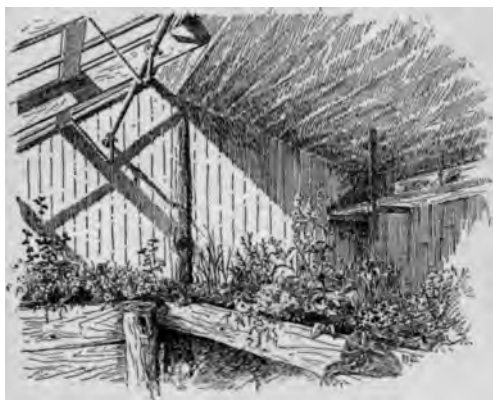
Sand or gravel, 1 foot deep, makes the best floor, or half sand and half loam where plants are to be heeled-in. A concrete floor should be used only where the drainage is absolutely perfect.

The sides and ends should be banked with leaves or other material. (See Fig. 3039). In the vicinity of Boston this should be done about November 15. The same covering can also be given to low roofs. The glass is protected by mats and shutters, much as in ordinary hotbeds. It is a good plan to have on hand an extra supply of dry meadow hay to give additional shelter in zero weather.



3041. A doorway in Fig. 3040.

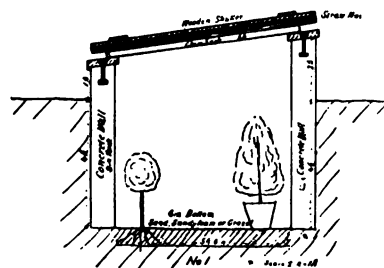
Pits like those shown in Figs. 3043 and 3045, like greenhouses, should carry more than one "crop." In early autumn they hold chrysanthemums, carnations, stevias, and the like; next *Rhododendron* (*Azalea*) *indica*, *Cytisus canariensis*, heaths, and the like, some of which remain for the winter, while others are replaced by



3042. Winter protection. Plants carried over winter in a living condition in an unheated greenhouse.

hardy shrubs, bulbs, and other plants for forcing. For spring and summer use, see above. In eastern Massachusetts gardeners begin to use them in September, but the final storage sometimes is not finished until Christmas. The longer the plants can be kept in the open air the better fitted they are for their winter quarters.

In the care of pits, watering and ventilation are of prime importance. When first housed the plants should be well watered, and, if this is carefully done, it will often be found that no further water is required for plants in tubs and large pots (10 inches or more). This also is true of heeled-in stock. Everything, however, should be so arranged that inspection is easy, and water should be given when necessary. Plants on the shelves, particularly in small pots (4-inch), will go dry oftener than those placed on the gravel floor. It is best to water on bright days, when the sashes can be removed. The great difficulty in keeping plants in good condition is owing to the condensation of moisture within the pits at times when it is impossible to open them on account of severe weather; therefore no more water should be given than is absolutely needed. As long as the weather permits, keep the sashes off or the windows open night and day, and afterward open up whenever possible. On sunny days ventilate whenever the thermometer registers over 20° F., but do not begin until the sun strikes the frames, and shut off early in the afternoon. On mild days, with the mercury above freezing, remove the sashes entirely. This is the best way to get rid of the moisture-laden air, and is essential for keeping evergreen plants with soft foliage in good condition.

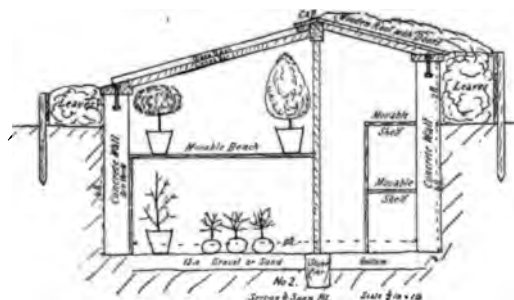


3043. One of the simplest and least expensive forms of cold pit for small and medium-sized plants.

To change the air in large cellars is more troublesome; here it is advisable to build an open fireplace in which a brisk fire may be kindled on mild days when all windows can be unclosed, thus obtaining a

better circulation than is otherwise possible. Sometimes these large cellars have a line of hot-water pipes or other means of heating, by which not only is better ventilation secured but also additional protection in severe weather.

An unheated greenhouse (Fig. 3042) can sometimes be used advantageously, not only for protection but, if it is warm enough, for growing plants in spring and autumn, and to a certain extent in winter. It is really a pit 5 or 6 feet deep built below ground and attached on the south side to some building already on the place. It might not be satisfactory for the extreme North but in southern New England and the middle states it is a great help: in European gardens it is sometimes called an alpine house, or, if it is larger and better built, a winter-garden. Give a southern exposure and have it so arranged that the floor is on the same or nearly the same level as the cellar floor; if this cellar is heated, so much the better. The cellar will be convenient for various operations, also for storing soil and tools; water should be handy. A door between it and the cellar is a necessity, but there need be none on the outside. The form of roof can be either lean-to or three-quarters span; in the latter form boarding, double if possible, can cover the roof next the house. Use double glazed glass and provide plenty of ventilation by glass or board shutters; this last is most important. The dimensions should not be less than 10 feet in width and may be more; the length can be any multiple of three so that hotbed sash can be used for the roof. The interior layout should be a walk, not over 2 feet wide, so placed that convenient and economical access is given the plants. These may be grown on benches, either solid or of boards, or planted in the earth. The great advantage of such a structure is that the plants can be handled from the inside in all weathers. The hardier plants, like wallflowers and violets, bloom all winter; in autumn it can be used to prolong the chrysanthemum season, in spring it is a good place for starting seedlings, e. g., lettuce, cauliflower, and cabbage, and, if warm enough, an inside hotbed can be



3044. A well-ventilated cold pit, roomier than the preceding and not much more expensive.

made to start tomatoes, peppers and eggplant also; in it most of the plants named below can be stored or grown. Many plants of doubtful hardiness or of small size can be wintered and tried out. It is much simpler to handle than pits or frames, largely on account of easy access and the storage capabilities of the cellar. It makes a good place to store plants for forcing and will even flower well tulips, hyacinths, and narcissi. A three-quarters span 12 by 15 feet with 8 feet of glass roof, in southern Massachusetts, well protected in all ways, has recorded on a self-registering thermometer only 24° F. in the last three years, outside temperature going as low as -10° F.

Following is a list of plants that may be wintered in pits and frames with satisfactory results. The list is made for the neighborhood of Boston.

A. *Hardy plants.*

1. Nursery stock of every description.
2. Stocks, cions, and cuttings for winter work.
3. Young nursery stock,—seedlings, cuttings, or grafts too delicate for planting in autumn.
4. Hardy plants for forcing or winter decoration.

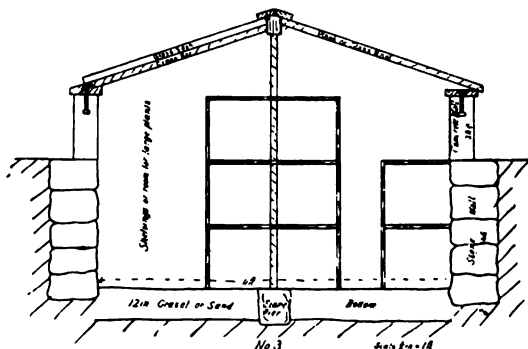
The temperature of pit or cellar for the above plants should be 35° F. or even lower occasionally. The larger plants should be heeled-in on the floor in sandy loam or in bunk-like shelves along the sides. Instead of loam, sphagnum can be used and is particularly good for cuttings and grafting stock. The very young stock is stored in flats or pans in which it has been grown. For forcing stock, see *Forcing*, pages 1265-1267.

AA. *Tender and half-hardy plants.*

Those marked with a star (*) are more tender and should not be exposed to frost. They should also be kept in the driest part of the pit.

1. *Alstroemeria*, *canna*, *dahlia*, *gladiolus*, *Milla biflora*, *montbretia*, *oxalis* for summer bedding, *tuberose*, *tigridia*, *Zephyranthes Atamasco*, *Z. candida*. Keep the above in dry house-cellar, where no frost penetrates, temperature 35° to 40° F. Dahlias and cannas can be covered with dry sand if prone to wilt. Tigridias should be hung up in bags to avoid mice.

2. *Agave*, *aloe*, *Lippia citriodora*, *Datura suaveolens*, some of the harder cacti, e. g., *Selenicereus grandiflorus* and *Opuntia Ficus-indica*, *Cordyline indivisa*,

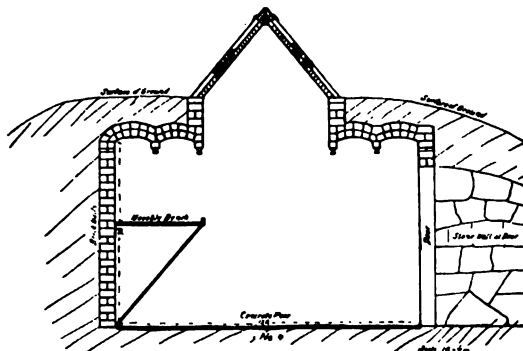


3045. A shelved cold pit for wintering young stock grown in flats, seedlings, rooted cuttings and grafts.

fuchsia, *Yucca gloriosa* and probably other genera and species of succulent plants. Keep at temperature 35° to 40° F. in a very dry house-cellar, with as much light as possible; too much moisture is destructive.

3. *Abelia* in variety, **abutilon*, **acacia*, *Acanthus mollis*, **Agapanthus umbellatus*, *Araucaria imbricata* and *A. excelsa*, *Aucuba japonica*, bamboos, *Buxus sempervirens*, **Callistemon* sorts, *Calluna vulgaris*, **Camellia* (different species, including the tea plant), *Ceanothus azureus*, *Cedrus Libani* and *C. Deodara*, *Cephalotaxus drupacea*, **citrus* in variety, *cistus* (different species), *cotoneaster* (tender sorts), *Cryptomeria japonica*, *cupressus* (tender sorts), **Cytisus canariensis* and **C. racemosus*, **Daphne odora*, **erica* (hardier sorts), *Eriobotrya japonica*, *Erythrina Crista-galli*, **Eugenia Jambos*, *Erythronium japonica* (tender varieties), *Ficus Carica*, *Gelsemium sempervirens*, *Gordonia alataamaha*, grapes (tender kinds), *Hedera helix*, **Hibiscus Rosa-sinensis*, *Hydrangea hortensis*, *Ilex Aquifolium*, *kniphofia*, *laurestinus*, *Laurus nobilis*, *lagerstroemia*, *Magnolia grandiflora*, **Meratia praezox*, *Myrtus communis*, **Nerium Oleander*, *Olea europaea*, **Osmanthus fragrans* and *O. Aquifolium*, *Passiflora carulea*, *pernettya*, *Phormium tenax*, **Pittosporum Tobira* and others, *Plumbago capensis*, *Podocarpus macrophylla* var. *Maki*, *Prunus Laurocerasus* and others, **Psidium Guajava*, **Punica Granatum*, *retinis-*

pora in variety, *rhododendron* (tender hybrids), *Rhododendron indicum*, *Romneya Coulleri*, roses (Bourbon, Noisette, China, Bengal, and other tender varieties), *Rosmarinus officinalis*, *Senecio grande*, *Sequoia gigantea*, *taxus*, *Trachelospermum jasminoides*, *Ulex europaeus*.



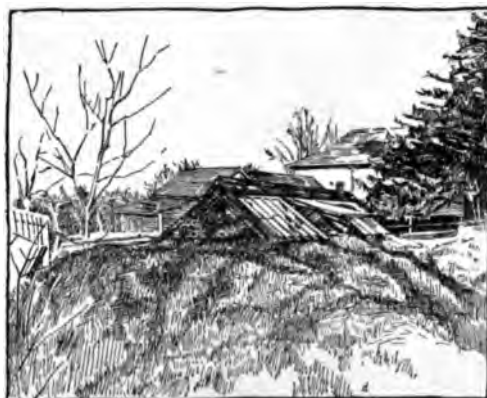
3046. A small plant-cellar for wintering large plants. It is also excellent for storing vegetables and fruits. It combines perfect ventilation with extremely good protection against frost.

The above plants are commonly handled in pits for various reasons. In eastern Massachusetts, with the possible exception of those marked thus (*), they will bear a few degrees of frost, if not too long continued, without harm. The average temperatures of the pit should be just above freezing, say 35° F. The value of these plants depends upon not only carrying them through the winter in good condition, but also in giving them a good start in the spring. For this purpose a cool greenhouse must be provided; a cold graperly or a house constructed from the sashes used on the pits is equally good, in which the plants can be properly grown until it is warm enough to put them out-of-doors.

4. *Anemone japonica* and *A. coronaria*, *Bellis perennis*, *Dianthus Caryophyllus* (clove pinks and European carnations from seeds), *Galax aphylla*, *myosotis*, *primula* in variety, including *auricula*, *Persian ranunculus*, *Viola odorata* (tender sorts), pansies, wall-flowers, lettuce, cabbage, cauliflower and parsley. These plants are wintered in coldframes, which should vary in depth with the size of the plant; sometimes the plants are grown and flowered in the frame, at others they are bedded out when the season permits.

5. *Arisæma*, *arum*, *calochortus* (different species), *freesia* in variety, *iris* (tender species), *ixia*, *sparaxis*. The above plants can be potted and carried in a pit or frame until wanted in the greenhouse.

B. M. WATSON.



3047. The roof of Fig. 3046.

Shrubs, small trees, and woody vines hardy in the northeastern United States.

The use of shrubs in landscape planting is explained in the preceding articles of this symposium on Planting. The illustrations, Figs. 3048 to 3060 inclusive, indicate the habit of some of the species.

- 1 before name means plant is low, 6 inches to 2 feet.
 2 means plant is small, 3 to 5 feet.
 3 means plant is medium, 6 to 8 feet.
 4 means plant is large, 10 to 15 feet.
 D means dioecious, i. e., only one sex on a plant. Fruiting (i. e., pistillate) plants must be secured with also one or more pollen-bearing (i. e., staminate) plants.
 E means plant is evergreen.
 e means plant is good for edging (low, neat, and compact).
 G means plant is good ground-cover (trailing or creeping).
 H means plant is hedge material.
 P means requires protection in climate of Boston.
 S means semi-evergreen (holding leaves till December or later).
 V means plant is a vine.

- EP1—*Abelia grandiflora* (much used in the South).
 3—*Acanthopanax pentaphyllum*.
 4—*Acer campestre* (small compact tree, dense foliage).
 4—*Acer ginnala*.
 3—*Acer palmatum* (often large but slow-growing).
 4—*Acer pennsylvanicum*.
 H3 or 4—*Acer platanoides* var. *globosum* (a dwarf dense slow-growing variety of the Norway maple).
 V—*Actinidia arguta*.
 4—*Aesculus parviflora*.
 SV—*Akebia quinata*.
 4—*Alnus incana*.
 Ee1—*Alysum gemonense* (6 inches).
 4—*Amelanchier canadensis*.
 4—*Amelanchier oblongifolia* (A. obovalis).
 2—*Amorpha canescens*.
 V—*Ampelopsis heterophylla*.
 EG1—*Arctostaphylos Uva-ursi*.
 V—*Aristolochia macrophylla* (A. Sipho).
 2—*Aronia arbutifolia*.
 2—*Aronia melanocarpa*. These two aronias will grow 6 to 8 feet, but are better if kept low and vigorous by frequent thinning out and renewal from the base.
 EP1—*Arundinaria japonica*.
 Ee1—*Aubrietia deltoidea* var. *gracis*.
 S2—*Baccharis halimifolia*.
 EP1—*Bambusa disticha*.
 4—*Benzoin astivale* (B. odoriferum).
 4—*Berberis aristata*.
 3—*Berberis dictyophylla*.
 EP2—*Berberis Sargentiana* (2 to 3 feet).
 H2—*Berberis Thunbergii* (occasionally 6 feet).
 EeP1—*Berberis verruculosa* (1 to 2 feet).
 H3—*Berberis vulgaris*.
 HS2—*Berberis Wilsonae* (2 to 3 feet).
 2—*Betula pumila*.



3048. A good shrub, taking its natural and characteristic form.

- P2—*Buddleia Davidii* (B. variabilis) var. *magnifica* (if not protected may be cut to ground annually).
 EH2—*Buxus japonica* (a new and hardy box; will probably reach 8 feet but is slow-growing and easily restrained by clipping).
 EHP2—*Buxus sempervirens* (must be protected in the North, but is hardy and tree-like in the South).
 EHP1—*Buxus sempervirens* var. *suffruticosa*.
 1—*Callicarpa japonica*.
 1—*Callicarpa purpurea*. Both of these callicarpas are tender and require cutting back early in spring.
 EeG1—*Calluna vulgaris*. Succeeds best in United States if kept low and vigorous by heavy pruning early in spring. Flowers appear in summer.
 2—*Calycanthus fertilis*.

- V—*Campsis radicans*.
 2—*Campsis radicans* var. *speciosa*.
 3—*Caragana frutes*.
 2—*Caragana pygmaea*.
 4—*Caragana arborescens*.
 H4—*Carpinus Betulus*. Dense slow-growing tree, much used for hedges. Better than the native hornbeam, C. caroliniana.
 H3—*Carpinus Betulus* var. *globosa*. This is an upright, oval form of the above. It is very dense and compact and may reach 15 to 20 feet in height, but is very slow-growing and can be restrained easily. See page 2683.
 2—*Catalpa bignonioides* var. *nana*. This is known in the trade as C. Bungei, but is not the true C. Bungei from China. It is a dwarf variety of the southern catalpa (C. bignonioides). It is often grafted high on an upright stem, but if grown on its own roots it will make only a dense round bush.
 1—*Ceanothus americanus*.
 1—*Ceanothus hybridus*.
 V—*Celastrus scandens*.
 3—*Cephalanthus occidentalis*.
 4—*Cercis canadensis*.
 H2—*Chenomeles japonica*.
 1—*Chenomeles Maulei*.
 EH4—*Chamaecyparis nootkatensis*. This is a large timber tree of the north Pacific coast. It is hardy, but little known in the East. Its good qualities are compact oval shape and dense soft foliage. It is also slow-growing and may be restrained easily for small-scale planting. See page 2683.
 E4—*Chamaecyparis obtusa*.
 EH2—*Chamaecyparis obtusa* var. *nana*. This is the finest of the Japanese cypresses (Chamaecyparis), all of which were originally introduced in the trade under the name *Retinospora*. This form will reach 6 to 8 feet, but is dwarf and very slow-growing and can be restrained easily. Its foliage is small and blunt, dark green above with white Y-shaped lines below. The spray is in compact, concave, fan-shaped masses arranged laterally, producing very interesting horizontal lines and shadows.
 E4—*Chamaecyparis pisifera*.
 E4—*Chamaecyparis pisifera* var. *filifera*.
 E4—*Chamaecyparis pisifera* var. *plumosa*.
 E4—*Chamaecyparis pisifera* var. *squarrosa*.
 E or S1—*Chamaedaphne calyculata*.
 EG1—*Chimaphila maculata*.
 EG1—*Chimaphila umbellata*.
 4—*Chionanthus virginica*.
 V—*Clematis apiifolia*.
 V—*Clematis Henryi*.
 V—*Clematis Jackmannii*.
 V—*Clematis Jackmannii* var. *alba*.
 V—*Clematis montana* in variety.
 V—*Clematis paniculata*.
 V—*Clematis tangutica*.
 V—*Clematis texensis* (C. Viorna var. *coccinea*).
 V—*Clematis virginiana*.
 3—*Clethra alnifolia*.
 4—*Colutea arborescens*.
 1—*Comptonia asplenifolia*.
 Cornus (all shrubby cornuses are better if kept vigorous by constant thinning and renewal from base).
 3—*Cornus alba*.
 3—*Cornus alba* var. *sibirica*.
 4—*Cornus alternifolia* (small tree or tree-like shrub).
 3—*Cornus Amomum* (C. sericea).
 4—*Cornus florida* (large shrub or small tree, 20 feet).
 4—*Cornus florida* var. *rubra* (shrub or small tree, 20 feet).
 4—*Cornus mas* (small compact tree, 15 to 20 feet).
 3—*Cornus racemosa* (C. candidissima and C. paniculata).
 3—*Cornus rugosa* (C. circinata).
 3—*Cornus sanguinea* var. *viridissima*.
 3—*Cornus stolonifera*.
 3—*Cornus stolonifera* var. *flaviramea*.
 3—*Corylus americana*.
 3—*Corylus Avellana*.
 4—*Corylus maxima*.
 3—*Corylus rostrata*.
 4—*Cotinus Coggygia*.
 EeP1—*Cotoneaster adpressa* (6 to 12 inches, slow-growing).
 PS2—*Cotoneaster Franchetii* (occasionally larger).
 1—*Cotoneaster horizontalis*.
 EGP1—*Cotoneaster microphylla* (4 to 6 inches; flatter than C. adpressa and better as ground-cover in rock-garden).
 2—*Cotoneaster racemiflora*.
 2—*Cotoneaster Simonsii*.
 2—*Cotoneaster tomentosus*.
 H4—*Crataegus coccinea*. All these thorns are better as natural screens with room to spread at the bottom than when confined in restricted hedge lines.
 H4—*Crataegus Crus-galli*.
 H4—*Crataegus Oxyacantha* var. *Paulii*.
 4—*Crataegus Phenopyrum* (C. cordata).
 H4—*Crataegus punctata*.
 4—*Crataegus tomentosa*.
 PS1—*Cytisus hirsutus*.
 2—*Cytisus ratisbonensis* (2 to 3 feet).
 P2—*Cytisus scoparius*.

- Ee1—*Daphne Cneorum*.
 2—*Daphne Mesereum*.
 2—*Daphne Mesereum* var. *alba*.
 E2—*Daphne pontica*.
 1—*Deutzia gracilis* (2 feet).
 2—*Deutzia Lemoinei* (3 to 4 feet).
 3—*Deutzia scabra* var. *florae-pleno* (Pride of Rochester).
 1—*Diervilla Lonicera*.
 3—*Diervilla hybrida* in variety (Le Printemps is early pink; Eva Rathke is late red).
 H2—*Dirca palustris*. This is a native shrub with flexible leathery twigs, small yellow flowers in early spring, good light green foliage in summer, and yellow color in autumn.
 4—*Elaeagnus angustifolia*.
 3—*Elaeagnus multiflora* (E. longipes).
 2—*Enkianthus perulatus*.
 E1—*Epigaea repens* (4 inches).
 Ee1—*Erica carnea* (6 inches; flower-buds conspicuous all winter; foliage glossy).
 Ee1—*Erica carnea* var. *alba*.
 Ee1—*Erica Tetralix* (6 inches; summer-blooming; no winter buds visible; foliage grayish).
 H3—*Evonymus alata*.
 4—*Evonymus europaea*.
 G1—*Evonymus obovata* (1 foot).
 EGHV2—*Evonymus radicans* var. *vegeta*. This is the hardiest evergreen vine for brick and stone. It is also used for low mass planting, for hedges and edging, and for ground-cover. The fruit in all varieties is an orange and red berry like that of *Celastrus scandens*. But not all plants fruit, and therefore care should be taken to select stocks from fruiting plants.
 3—*Exochorda racemosa*.
 3—*Forsythia suspensa*. Shrub with recurving stems, excellent for trailing over a bank or hanging down a wall. Has good definite form and therefore the best forsythia for individual specimen planting.
 3—*Forsythia suspensa* var. *Fortunei*.
 3—*Forsythia viridissima*.
 2—*Fothergilla major*.
 EG1—*Gaultheria procumbens*.
 1—*Gaylussacia baccata* (G. resinosa).
 Ee1—*Gaylussacia brachycera*.
 1—*Genista tinctoria*.
 4—*Halesia carolina* (H. tetraptera).
 3—*Hamodendron halodendron*.
 4—*Hamamelis japonica* var. *arborescens*.
 4—*Hamamelis mollis*.
 2—*Hamamelis vernalis* (occasionally 6 feet).
 4—*Hamamelis virginiana*.
 EGPV—*Hedera helix*.
 EeG1—*Helianthemum Chamæcistus* (H. vulgare).
 H4—*Hibiscus syriacus*.
 4—*Hippophae rhamnoides*.
 2—*Hydrangea arborescens* var. *grandiflora*.
 4—*Hydrangea paniculata* var. *grandiflora* (15 feet).
 GV—*Hydrangea petiolaris*.
 1—*Hydrangea quercifolia* (cut to ground annually).
 1—*Hydrangea radiata* (cut to ground annually).
 2—*Hypericum aureum*.
 e1—*Hypericum Buckleii*.
 EGP1—*Hypericum calycinum* (6 inches to 1 foot).
 2—*Hypericum prolificum*.
 Ee1—*Iberis sempervirens* (6 inches).
 Ee1—*Iberis Tenoreana* (6 inches).
 DEHP3—*Ilex crenata*.
 D2—*Ilex decidua*.
 DEH2—*Ilex glabra*.
 DEH4—*Ilex opaca*.
 D3—*Ilex verticillata*.
 1—*Indigofera Kirilowii* (cut to ground annually).
 DEH4—*Juniperus chinensis*. All forms of *Juniperus* in this list are very slow-growing except *J. communis* var. *hibernica*.
 E2—*Juniperus chinensis* var. *erecta*.
 DE3—*Juniperus chinensis* var. *Pfitzeriana*.
 DEcG1—*Juniperus chinensis* var. *procumbens*.
 DE2—*Juniperus communis*.
 DEH4—*Juniperus communis* var. *hibernica*.
 DEG1—*Juniperus communis* var. *montana* (1 foot high).
 DEG1—*Juniperus horizontalis* (J. Sabina var. *procumbens*).
 DEG1—*Juniperus horizontalis* var. *Douglasii*.
 DE3—*Juniperus Sabina*.
 DEc1—*Juniperus Sabina* var. *tamariscifolia* (2 to 3 feet, neat and compact and very slow-growing, with short horizontal branches and upcurving branchlets).
 E1—*Kalmia angustifolia*.
 E3—*Kalmia latifolia* (sometimes higher).
 2—*Kerria japonica*.
 4—*Koeleruteria paniculata* (round-headed tree 20 to 30 feet high; summer bloomer).
 4—*Laburnum alpinum* (compact shrub or small tree 20 to 30 feet, more hardy than the common L. vulgare).
 Ee1—*Leiophyllum buxifolium* var. *prostratum*.
 2—*Lespedeza bicolor*.
 EG1—*Leucothoe Catesbaei* (occasionally 3 feet).
 H4—*Ligustrum Iboia*.
 H2—*Ligustrum Iboia* var. *Regelianum*.
 H82—*Ligustrum ovalifolium*. See remarks on page 2683.
 H84—*Ligustrum vulgare*, the common privet.

- 4—*Lonicera bella* var. *rosea*.
 3—*Lonicera fragrantissima*.
 V—*Lonicera Heckrottii*.
 SV—*Lonicera Henryi*.
 SV—*Lonicera japonica* var. *Halliana*.
 4—*Lonicera Maackii*.
 3—*Lonicera Morrowii*.
 V—*Lonicera Periclymenum*.
 V—*Lonicera sempervirens*.
 e1—*Lonicera spinosa*.
 4—*Lonicera tatarica*.
 2—*Lonicera thibetica*.
 S2—*Lycium chinense*.
 S2—*Lycium halimifolium* (L. vulgare). These lyciums have same general habit as *Forsythia suspensa*, but are more vigorous. Their branches root easily and the plants may become a nuisance and hard to eradicate. See note on page 2681.



3049. A good shrub ruined by the shears.

- 4—*Magnolia denudata* (M. Yulan) (tree, 30 to 40 feet).
 S4—*Magnolia glauca* (M. virginiana).
 4—*Magnolia Lenzii*.
 4—*Magnolia Soulangeana*.
 4—*Magnolia stellata*.
 EP1—*Mahonia Aquifolium* (2 feet).
 EP2—*Mahonia japonica*.
 EG1—*Mahonia repens* (1 foot).
 V—*Menispermum canadense*.
 EG1—*Mitchella repens* (1 to 2 inches; very flat and creeping).
 D84—*Myrica carolinensis*. Can be kept lower very easily by thinning out and renewing from the base. Is still known in commerce as *M. cerifera*. Ranges north to Nova Scotia near the coast. Is more shrubby, with blunt leaves which are broader and more oblong than those of *M. cerifera*. This latter is a southern plant, closely related but probably tender in New England. It is more tree-like, with pointed leaves which are narrower and more lanceolate than those of *M. carolinensis*.
 1—*Myrica Gale*.
 2—*Neviusia alabamensis*.
 4—*Oxydendrum arboreum*.
 EeP1—*Pachistima Canbyi* (4 to 5 inches).
 EP1—*Pachistima myrsinites* (1-2 feet).
 EeG1—*Pachysandra terminalis* (6 inches to 1 foot).
 1—*Paeonia suffruticosa* (P. Moutan).
 V—*Parthenocissus quinquefolia*.
 V—*Parthenocissus tricuspidata*.
 3—*Philadelphus coronarius* (often 10 feet).
 1—*Philadelphus coronarius* var. *nanus* (2 to 3 feet; very dense and compact; seldom has flowers).
 3—*Philadelphus inodorus*.
 4—*Philadelphus pubescens* (P. grandiflorus or P. latifolius).
 2—*Philadelphus Lemoinei* (in variety, especially var. *Avalanche*, *Candelabre*, and *Gerbe de Neige*).
 2—*Philadelphus microphyllus* (this and P. coronarius are the original parents of the Lemoine hybrids).
 4—*Photinia villosa*.
 3 or 4—*Physocarpus opulifolius*.
 Ee1—*Picea excelsa* dwarf varieties, as var. *Clanbrasiliana* (2 to 3 feet) and var. *Maxwellii* (1 foot).
 Ee1—*Picea mariana* var. *Douglasii* (1 foot).
 EH—*Picea orientalis*. This is a large tree but is adapted to small-scale planting because very slow-growing and also because easily restrained. Foliage small, blunt, and dark glossy green.
 E2—*Pieris floribunda* (2 to 3 feet).
 EP2—*Pieris japonica*.
 2—*Pieris mariana* (2 to 3 feet).
 E2—*Pinus densiflora* var. *pumila*.
 E4—*Pinus montana* (a low bushy tree 20 feet high and 20 feet broad; very slow-growing).
 E2—*Pinus montana* var. *Mughus*.
 V—*Polygonum baldschuanicum*.
 2—*Potentilla fruticosa* (2 to 3 feet).
 eS1—*Potentilla tridentata* (6 inches).
 EGP1—*Prunus Laurocerasus* var. *schipkaensis*.
 2—*Prunus maritima*.

- 2—*Prunus pumila*.
 3—*Prunus tomentosa*.
 3—*Prunus triloba* var. *flore-pleno*.
 4—*Ptelea trifoliata*.
 EeHP1—*Pyracantha coccinea* var. *pauciflora* (plant low, dense, and thorny).
 4—*Pyrus coronaria*.
 4—*Pyrus Halliana*.
 4—*Pyrus ioensis*, Bechtel's variety.
 4—*Pyrus pulcherrima* (small tree).
 4—*Quercus ilicifolia* (*Q. nana*).
 H4—*Rhamnus cathartica*.
 2—*Rhamnus fallax*.
 4—*Rhamnus Frangula*.
 EeHP1—*Rhododendron amonum*.
 3—*Rhododendron arborecens*.
 E1—*Rhododendron arbutifolium* (*R. Wilsonii*).
 E2—*Rhododendron*, *Boule de Neige* (white, early).
 3—*Rhododendron calendulaceum*.
 E2—*Rhododendron caractacus* (bright red, bloom medium).
 E2—*Rhododendron carolinianum* (*R. punctatum* in part).
 This is a low, compact rhododendron native to the high mountains of North Carolina, with broad leaves and early rose-pink flowers in late May before the new leaves appear. It was placed on the market under the name *R. punctatum*. The real *R. punctatum* is a taller looser-growing shrub, native to lower altitudes from North Carolina south, with narrower leaves, and flowers that bloom a month later than those of *R. carolinianum* and are more or less overtopped and obscured by new leaf-growth. The old *R. punctatum* is now called *R. minus*. (See *Rhodora*, vol. 14, No. 162, June, 1912.)
 E3—*Rhododendron catawbiense* var. *album* (this has same compact habit as *R. catawbiense*, but flowers are white instead of magenta, early).
 E3—*Rhododendron delicatissimum* (bluish-white, late).
 E3—*Rhododendron Everatanum* (lavender, early).
 EeHP1—*Rhododendron Hinodigiri*.
 E3—*Rhododendron*, H. W. Sargent (red, late).
 3—*Rhododendron Kaempferi*.
 E3—*Rhododendron*, Lady Armstrong (pink, early to medium).
 E4—*Rhododendron maximum*.
 2—*Rhododendron mucronulatum*.
 EeH1—*Rhododendron myrtifolium*.
 2—*Rhododendron nudiflorum*.
 E3—*Rhododendron purpureum elegans* (purple, bloom medium).
 3—*Rhododendron Vaseyi*.
 2—*Rhododendron viscosum*.
 3—*Rhodotypos kerrioides*.
 G2—*Rhus canadensis* (*R. aromatica*).
 4—*Rhus copallina*.
 4—*Rhus glabra*.
 4—*Rhus hirta*.
 4—*Rhus typhina* (*R. hirta*).
 2—*Ribes alpinum*.
 2—*Ribes cereum*.
 3—*Ribes odoratum* (*R. aureum*) (*Buffalo, Flowering, or Missouri Currant*).
 2—*Ribes pinetorum*.
 2—*Robinia hispida*.
 2—*Robinia Kelseyi*.
 2—*Rosa carolina*.
 2—*Rosa cinnamomea*.
 2—*Rosa Harisonii*.
 2—*Rosa multiflora* (5 to 6 feet or higher).
 1—*Rosa nitida* (2 ft.).
 2—*Rosa rubiginosa*.
 2—*Rosa rugosa*.
 2—*Rosa rugosa* var. *Blanche de Coubert* (beautiful semi-double white).
 2—*Rosa setigera* (2 to 4 feet).
 2—*Rosa spinosissima* var. *altaica* (often 5 feet).
 1—*Rosa virginiana* (*R. lucida*) (2 feet).
 GS1V—*Rosa wichuraiana* (1 foot).
 2—*Rubus allegheniensis*.
 2—*Rubus crataegifolius*.
 GS1—*Rubus hispidus* (6 inches).
 2—*Rubus occidentalis*.
 2—*Rubus odoratus*.
 GS1—*Rubus spectabilis* var. *plena* (*R. Linkianus* or *R. ulmi-folius*) (18 inches).
 G1—*Rubus procumbens* (*R. villosus*) (12 inches).
 4—*Salix Caprea*.
 4—*Salix cordata*.
 4—*Salix discolor*.



3050. One value of the shrub lies in its bloom.—*Clethra alnifolia*.

- 2—*Salix humilis* (sometimes reaches 6 to 8 feet).
 4—*Salix purpurea*.
 e1—*Salix tristis* (1 foot to 18 inches).
 3—*Sambucus canadensis* (sometimes over 10 feet).
 3—*Sambucus racemosa*.



3051. *Deutzia Lemoinei*.

- GV—*Schisophragma hydrangeoides*.
 4—*Shepherdia argentea*.
 2—*Shepherdia canadensis*.
 V—*Smilax glauca*.
 V—*Smilax rotundifolia*.
 3—*Sophora viciifolia* (new plant from China; will probably grow 10 feet under cultivation).
 2—*Sorbaria Aitchisonii* (this plant is very handsome, but tender at Boston).
 2—*Sorbaria arborea* (most handsome hardy sorbaria).
 2—*Sorbaria sorbifolia*.
 2—*Spiraea alba* (*S. salicifolia*).
 2—*Spiraea arguta*.
 3—*Spiraea Billardii* (*S. Lenneana*).
 3—*Spiraea bracteata*.
 eH1—*Spiraea Bumalda*, Anthony Waterer variety (2 feet).
 3—*Spiraea crenata*.
 3—*Spiraea Douglasii*.
 3—*Spiraea gemmata*.
 2—*Spiraea japonica* (*S. callosa*) (3 feet).
 3—*Spiraea prunifolia* var. *flore-pleno*.
 2—*Spiraea salicifolia* (*S. alba*).
 2—*Spiraea Thunbergii*.
 2—*Spiraea tomentosa*.
 2—*Spiraea trilobata*.
 3—*Spiraea Van Houttei*.
 3—*Staphylea Bumalda*.
 3—*Staphylea trifoliata* (sometimes 12 feet high).
 2—*Stephanandra incisa*.
 2—*Stephanandra Tanaka*.
 4—*Stewartia Pseudo-camellia*.
 4—*Styrax japonica*.
 2—*Symphoricarpos albus*.
 2—*Symphoricarpos orbiculatus* (2 to 3 feet).
 4—*Symplocos crataegoides*.
 4—*Syringa chinensis* (*S. rothomagensis*) var. *alba*.
 4—*Syringa chinensis* (*S. rothomagensis*) var. *rubra*.
 4—*Syringa japonica* (small compact tree, to 30 feet).
 4—*Syringa oblata*.
 4—*Syringa persica* var. *alba*.
 4—*Syringa persica* var. *rubra*.
 4—*Syringa villosa*.
 H4—*Syringa vulgaris* (there are many color varieties).
 3—*Tamarix*.
 Del—*Taxus baccata* var. *repandens*.
 DG1—*Taxus canadensis* (good in shade but not so satisfactory as other forms in full sun).
 DH3—*Taxus cuspidata*.
 DH2—*Taxus cuspidata* var. *nana*.
 EH4—*Thuja occidentalis* (dense pyramidal tree; very slow-growing, but may reach 50 to 60 feet in time).
 EeH1—*Thuja occidentalis* var. *nana* (this may reach 3 to 4 feet, but is very slow-growing and easily restrained by clipping).
 EH4—*Thuja orientalis*. More handsome than our native arborvitae. The branches and branchlets are more distinctly vertical and the foliage is smaller and brighter green.
 EeH1—*Thuja orientalis* var. *Sieboldii* or *nana* (this may reach 3 to 4 feet, but is very slow-growing and is easily restrained by clipping).
 EeG1—*Thymus Serpyllum* (4 to 5 inches).
 EH 3 or 4—*Tsuga canadensis*. The most graceful and effective evergreen tree for mass-planting. Takes up less room than white pine and is much slower-growing. Can be restrained easily and therefore is adapted to hedge and small-scale plantings.
 2—*Vaccinium corymbosum*.
 eG1—*Vaccinium pennsylvanicum* (1 foot).
 1—*Vaccinium vacillans*.
 2—*Viburnum acerifolium*.
 2—*Viburnum alnifolium* (*V. lantanoides*).
 4—*Viburnum americanum*.
 2—*Viburnum Carlesii* (first viburnum to flower, and very fragrant; buds are pink before opening; new plant from Korea).

- 3—*Viburnum cassinoides*.
H3 or 4—*Viburnum dentatum* (will reach 10 to 12 feet, but may be restrained easily by gradual renewal from the base).
3—*Viburnum dilatatum*.
H4—*Viburnum Lantana*.
4—*Viburnum Lentago*.
4—*Viburnum Opulus*.
1—*Viburnum Opulus* var. *nanum* (2 to 3 feet, very dense and compact; seldom has flowers).
4—*Viburnum Opulus* var. *sterile*.
H4—*Viburnum prunifolium*.
3—*Viburnum pubescens*.
EP2—*Viburnum rhytidophyllum*. Grows to 10 feet in China but needs protection in Boston and Rochester either by artificial covering or special location providing shade from the winter sun. Even when so protected the flower-buds are usually killed just like those of *Andromeda japonica*.
4—*Viburnum Sieboldii*.
3—*Viburnum tomentosum* (sometimes larger).
3—*Viburnum tomentosum* var. *plenum*.
H3 or 4—*Viburnum venosum* (*V. molle*). Similar to *V. dentatum* but more vigorous with broader leaves, rougher twigs and later bloom. Will grow to 12 feet but easily restrained by gradual renewal from the base.
3—*Viburnum Wrightii*.
EcG1—*Vinca minor*.
3—*Vitis incisa*.
V—*Vitis Coignetia*.
V—*Wisteria chinensis*.
V—*Wisteria chinensis* var. *alba*.
G1—*Xanthorrhiza apiifolia*.
1—*Yucca angustifolia*.
1—*Yucca filamentosa*.
S2—*Zenobia pulverulenta* (foliage and twigs blue-gray; very handsome).

RALPH W. CURTIS.

Shrubs for the Middle West.

The most popular shrubs in the Middle West, as in any new country, are usually of foreign origin. However, the native shrubs are beginning to play a great part in restoring and intensifying the characteristic beauty of this region. The dominant feature of middle western shrubbery is not apparent to all. This is largely due to the fact that the Middle West contains no unique species that compel universal admiration like the mountain laurel and rhododendrons, which are the crowning glory of the East. Every shrub of importance native to the Middle West is also native to the East. While the Middle West may rival the East in the luxuriance of its shrubbery, it is poorer in species, both native and foreign. About two-fifths of the middle western shrubs that are in general cultivation bear their flowers in flat clusters. These have been called "symbols of the prairie" since they repeat many times on a small scale the great line of the horizon, which is the strongest feature of the middle western scenery, whether wild or cultivated, treeless or forested. Repetition of the horizontal is conspicuous enough wherever hawthorns and prairie crab-apples (*Pyrus ioensis*) are abundant, owing to their strong horizontal branching. Few shrubs, however, have stratified branches. Their suggestion of the prairie is subtler and less insistent, because it appears only in the bloom. The boldest repeater of the prairie among the shrubs is the American black elder, with clusters 6 to 8 inches across. The viburnums and dogwoods have smaller clusters, ranging from 5 inches in diameter down to 2 inches. When wood and prairie meet, the prairie note is sounded more strongly by shrubs with horizontal branches, especially witch-hazel, and by juneberry and gray dogwood which, though

3052. *Sambucus canadensis*.

erect when young, become intensely stratified when old. This is an important part of the prairie style of landscape gardening. The following lists are therefore classified according to this idea.

Stratified shrubs. (Those marked * have horizontal branches, at least when old. The others have flat clusters of flowers.)

Low shrubs, suitable for foundation planting and edging borders: *Ceanothus americanus* and *C. ovatus*; *Hydrangea arborescens*; *Viburnum acerifolium* and *V. pubescens*.

3053. *Spiraea Van Houttei*.

Medium-high shrubs, ordinarily 5 to 6 feet: *Cornus Amomum*, *C. racemosa** (or *C. paniculata*), and *C. stolonifera*; *Sambucus pubens*, *S. canadensis*, and its var. *acutiloba*; *Viburnum cassinoides*, *V. dentatum*, *V. molle*, and *V. americanum*. The last-named is considered by botanists to be the same as the European *V. Opulus*, but the American form is considered to be freer from plant-lice and is superior in other ways.

Tall shrubs, suitable for the back of a border, corner of a house, or high foundation: *Aralia spinosa**; *Cornus alternifolia** and *C. rugosa** (or *C. circinata*); *Hamamelis virginiana**; *Physocarpus opulifolius*; *Viburnum Lentago* and *V. prunifolium*.

Non-stratified shrubs.

Low shrubs: *Amelanchier alnifolia* and var. *pumila*; *Diervilla trifida*; *Evonymus obovata*; *Prunus pumila*; *Rhus canadensis* (or *R. aromatica*); *Ribes americanum*; *Rosa virginiana* (or *R. blanda*), *R. carolina*, *R. humilis*, and *R. setigera*; *Rubus hispidus*; *Symphoricarpos occidentalis* and *S. orbiculatus*.

Medium-high shrubs: *Corylus americana*; *Evonymus americana*; *Ilex verticillata*; *Rhus copallina*, *R. glabra*, and *R. typhina*; *Ribes aureum* and *R. cynosbati*; *Spiraea alba*; *Symphoricarpos albus*.

Tall shrubs: *Aronia arbutifolia* and *A. melanocarpa*; *Benzoin aestivale*; *Cephalanthus occidentalis*; *Staphylea trifolia*; *Zanthoxylum americanum*.

The most significant plants in the above list, probably, are sumac and prairie rose. The sumac (*Rhus glabra*) was undoubtedly the most virile note on the wild prairie, where the summer foliage took on a wonderful gloss. It is still the most gorgeous color in the corn-belt, where brilliant reds are not commonly developed in autumn. The prairie rose, also known as the Michigan or Illinois rose (*Rosa setigera*), is now much planted beside front doors. The common wild rose of the open prairie is *Rosa humilis*, which, however, is familiar in the East, while *Rosa setigera* is decidedly more western in its range.

The middle western point of view may be indicated by brief notes on a few other species. *Ceanothus ovatus* is thought to be more refined in cultivation than New Jersey tea and has more "western color;" should combine well with *Lilium canadense* or *L. superbum*. *Cornus racemosa* has been called "sunset dogwood" because in autumn its countless red pedicels make a glow like the characteristic prairie sunset; this and

sumac are prominent in "sunset gardens." *Cornus rugosa* is a magnificent species, but must have shade. Although hazel (*Corylus*) may be considered "coarse" in the East, its rugged character pleases the Middle West and its autumn color is unique. *Hamamelis virginiana* is very popular because its yellow foliage lights up the autumn woods and because its stratified branches carry the prairie spirit into the woodland. *Sambucus pubens*, the red elder, will not thrive on clay or in full sun; it wants shade and prefers sandy soil. *Symphori-*



3054. Gardenia.

carpos orbiculatus is commonly called "buckbush," and is a familiar sight in pastures. *Viburnum acerifolium* is useful for the shady side of the house. *Viburnum pubescens* is the most floriferous of the viburnums and formerly common near Chicago. *Zanthoxylum americanum* is almost as common in woodlots as buckbush; the scent of the foliage generally pleases.

WILHELM MILLER.

Shrubs for street and park planting.

Eastern United States, northern section.

Berberis Thunbergii.
Ceanothus americana.
Cercis canadensis.
Cercis japonica.
Chaenomeles japonica (subject to San José scale).
Clethra alnifolia.
Cornus in variety (these are subject to scale insects).
Foraythia Fortunei.
Foraythia viridissima.
Hydrangea arborescens.
Hydrangea paniculata.
Kerria japonica.
Ligustrum Itoha.
Ligustrum Itoha var. *Regelianum*.
Lonicera Morrowii.
Lonicera tatarica.
Philadelphus in variety.
Physocarpus opulifolius.
Rhodotypos kerrioides.
Ribes in variety.
Rosa rugosa and other species.
Spiraea Billardii.
Spiraea Bumalda, including var. *Anthony Waterer*.
Spiraea japonica.
Spiraea japonica var. *alba*.
Spiraea carpinifolia.
Spiraea Van Houttei.
Symphoricarpos albus.
Symphoricarpos orbiculatus.
Syringa in variety.
Tamarix in variety (may be killed to the ground in the extreme North but will come again from the root).
Viburnum dentatum.
Viburnum Opulus.

Eastern United States, central section. (From Philadelphia and St. Louis southward, in addition to the shrubs for the northern section.)

Abelia grandiflora.
Buddleia variabilis varieties.
Callicarpa purpurea.
Caryopteris incana.
Deutzia in variety.
Evonymus in variety.
Forsythia suspensa.
Hypericum Moserianum.
Ilex in variety.
Jasminum in variety.
Ligustrum in variety.
Mahonia Aquifolium.
Spiraea in variety.
Staphylea pinnata.
Staphylea trifolia.
Stephanandra incisa.
Styrax japonica.

Eastern United States, southern section. (For use in addition to the two foregoing lists for points south of Wilmington, North Carolina, and Charleston, South Carolina, and westward in the southern half of the states on the Gulf of Mexico.)

Aucuba japonica.
Gardenia in variety.
Nerium Oleander.
Oemanthus Aquifolium.

Pittosporum Tobira.
Prunus caroliniana.
Prunus Laurocerasus.
Viburnum Tinus.

Shrubs for the seashore.

Berberis Thunbergii.
Hibiscus syriacus.
Hydrangea, both woody and semi-herbaceous.
Ilex opaca.
Juniperus virginiana.
Ligustrum in variety.
Myrica cerifera.

Rosa nitida.
Rosa rugosa.
Rosa Wichuraiana.
Spiraea in variety.
Symphoricarpos albus.
Symphoricarpos orbiculatus.
Tamarix in variety.

The ilex, the hibiscus, and some of the ligustrums will not be hardy on the extreme northern Atlantic seacoast but will be hardy much farther north on the shore than in the regions adjoining.

Shrubs for regions of little rainfall.

Berberis Thunbergii.
Elaeagnus, especially *E. angustifolia*.
Lonicera, especially *L. Morrowii* and *L. tatarica*.
Philadelphus Lewisii.
Prunus serotina.
Ribes, especially *R. aureum*.
Rosa arkansana of cult.
Rosa caroliniana var. *lucida*.
Rosa nitida.
Rosa rugosa.
Rosa setigera.
Spiraea in variety.
Symphoricarpos in variety.
Syringa, especially *S. chinensis*.
Tamarix in variety.

In the northern sections the tamarix will kill to the ground every winter but will come from the root. The tender spiraea should not be used north of Denver, Colorado.

Shrubs for the Pacific slope. (In addition to the plants suggested for the eastern United States. The lists for both the northern and central sections of the eastern states may be used on the North Pacific slope and all the eastern lists for the southern sections.)

Arbutus Unedo.
Ceanothus thyrsiflorus and other native species.
Cotoneaster in variety.
Crataegus in variety, especially *C. Pyracantha* (*Pyracantha* coccinea).
Elaeagnus in variety.
Evonymus in variety.
Sambucus racemosa.
Spartium junceum.
Spiraea arisefolia and others.
Veronica in variety.

Shrubs for the Southern section. (In addition to all these listed for the eastern United States and the above.)

Escallonia in variety.
Photinia arbutifolia.
Pittosporum in variety.

Prunus ilicifolia.
Prunus integrifolia.

F. L. MULFORD.

Shrubs for midcontinental region.

The following list of shrubs for the most part consists of kinds known to be perfectly hardy and to succeed in the region of St. Louis if planted with usual care and subsequently given reasonably good treatment. Many choice sorts which are not likely to be hardy much north of central Missouri without some protection are indicated by an asterisk (*). A few may not be generally known to the trade and hence procured with some difficulty at present but their value for this region was demonstrated by being grown several years at the Missouri Botanical Garden. Azalea and certain other Ericaceae, together with some allied genera like *Kalmia* that have formed attractive features in many plantations, are not included because they are generally short-lived and require more than ordinary care in planting and subsequent handling.

**Acanthopanax pentaphyllum*.
Æsculus parviflora.
Alnus Mitchelliana.
Alnus serrulata.
Amelanchier canadensis.
 **Amorpha canescens*.
Amorpha fruticosa.
Aronia arbutifolia.
 **Baccharis halmifolia*.
 **Bensoin festivale*.
Berberis Thunbergii.
Berberis vulgaris.
Berberis vulgaris var. *atro-purpurea*.
Betula nana.
Betula pumila.
 **Buddleia Davidii*.
 **Buddleia Lindleyana*.
Calycanthus fertilis.
Calycanthus floridus.
Calycanthus occidentalis.
 **Caragana arborescens*.
 **Caryopteris incana*.
 **Ceanothus americanus*.
Cephalanthus occidentalis.
Cercis canadensis.
Chenomeles japonica.
Clethra alnifolia.
 **Colutea arborescens*.
 **Comptonia asplenifolia*.
Cornus alba.
Cornus alba var. *sibirica*.
Cornus alternifolia.
Cornus Amonum.
Cornus mas.
Cornus racemosa.
Cornus rugosa.
Cornus sanguinea.
Cornus stolonifera.
Cornus stolonifera var. *flaviramea*.
 **Coronilla Emerus*.
Corylus americana.
Corylus Avellana var. *atro-purpurea*.
Corylus Avellana var. *laciniata*.
Cotinus Coggyria.
 **Cotoneaster acuminata*.
 **Cotoneaster racemiflora*.
Crataegus Crus-galli.
Crataegus Oxyacantha.
 **Daphne Mezereum*.
Deutzia gracilis.
Deutzia Lemoinei.
Deutzia scabra.
Deutzia scabra, "Pride of Rochester."
Deutzia scabra var. *Watereri*.
Diervilla floribunda.
Diervilla floribunda var. *grandiflora*.
Diervilla hybrida, "Eva Rathke."
Diervilla hybrida *Kosteriana* variegata.
Diervilla Lonicera.
Dicra palustris.
Eleagnus angustifolia.
Eleagnus argentea.
Eleagnus multiflora.
Eleagnus umbellata.
 **Evonymus alata*.
Evonymus americana.
Evonymus atropurpurea.
Evonymus Bungeana.
Evonymus europæa.
Evonymus obovata.
 **Evonymus radicans*.
 **Evonymus radicans* var. *vegeta*.
 **Exochorda racemosa*.
Forsythia intermedia.
Forsythia suspensa.
Forsythia viridissima.
Halimodendron halodendron.
Hamamelis virginiana.
Hibiscus syriacus, in variety.
Hibiscus syriacus var. *Meehanii*.
 **Hippophaë rhamnoides*.
Hydrangea arborescens var. *grandiflora*.
Hydrangea paniculata.
Hydrangea paniculata var. *grandiflora*.
 **Hydrangea quercifolia*.
 **Hypericum Moseianum*.
 **Ilex decidua*.
 **Ilex serrata*.
 **Ilex verticillata*.

**Itea virginica*.
 **Kerria japonica*.
 **Kerria japonica argenteo-variegata*.
 **Laburnum anagyroides*.
 **Leopedeza bicolor*.
 **Leopedeza Sieboldii*.
Ligustrum amurense.
Ligustrum Iboia var. *Regelianum*.
 **Ligustrum ovalifolium*.
 **Lonicera fragrantissima*.
Lonicera involucrata.
Lonicera Ledebourii.
Lonicera Morrowii.
Lonicera Ruprechtiana.
Lonicera Standishii.
Lonicera tatarica.
Lonicera tatarica var. *grandiflora*.
Lonicera tatarica var. *latifolia*.
Lonicera tatarica var. *pumilica*.
Lycium chinense.
Lycium halmifolium.
 **Magnolia Soulangeana*.
 **Magnolia Soulangeana* var. *Lemoinei*.
 **Magnolia Soulangeana* var. *speciosa*.
 **Magnolia stellata*.
Mahonia Aquifolium.
Philadelphus coronarius.
Philadelphus coronarius var. *flor-pleno*.
Philadelphus inodorus.
Philadelphus latus.
Philadelphus Lemoinei.
Philadelphus Lemoinei var. *erectus*.
Philadelphus pubescens.
Physocarpus opulifolius.
Physocarpus opulifolius var. *lutea*.
Potentilla fruticosa.
Prunus Amygdalus, and white variety.
Ptelea trifoliata.
 **Rhamnus alnifolia*.
Rhamnus caroliniana.
Rhamnus cathartica.
Rhamnus Frangula.
 **Rhodotypos kerrioides*.
Rhus canadensis.
Rhus copallina.
Rhus glabra.
Rhus glabra var. *laciniata*.
Rhus typhina.
Rhus typhina var. *laciniata*.
Ribes aureum.
Ribes Gordonianum.
Ribes sanguineum.
Robinia hispida.
Rubus odoratus.
Salix discolor.
Salix humilis.
Salix pentandra.
Salix petiolaris.
Salix purpurea.
Salix rostrata.
Salix sericea.
Salix tristis.
Sambucus canadensis.
Sambucus nigra.
Sambucus nigra var. *aurea*.
Sambucus nigra var. *laciniata*.
Sambucus racemosa.
Shepherdia argentea.
Sorbus melanocarpa.
Spiræa arguta.
Spiræa Billardii.
Spiræa Bumalda.
Spiræa Bumalda, "Anthony Waterer."
Spiræa Menziesii.
Spiræa prunifolia.
Spiræa prunifolia var. *flor-pleno*.
Spiræa salicifolia.
Spiræa Thunbergii.
Spiræa Van Houttei.
Staphylea colchica.
Staphylea trifolia.
 **Stephandra incisa*.
Syringa persica.
Syringa villosa.
Syringa vulgaris, in variety.
Symphoricarpos albus.
Symphoricarpos orbiculatus.
Tamarix africana.
Tamarix gallica.

Tamarix gallica indica.
Tamarix hispida festivale.
Tamarix tetandra purpurea.
Viburnum acerifolium.
Viburnum cassinoides.
Viburnum dentatum.
Viburnum Lantana.
Viburnum Lentago.

Viburnum molle.
Viburnum Opulus.
Viburnum Opulus var. *sterile*.
Viburnum tomentosum.
Viburnum prunifolium.
 **Vitex Agnus-castus*.
 **Xanthoceras sorbifolia*.
 **Xanthorrhiza apiifolia*.



3055. *Hydrangea paniculata* var. *grandiflora*.

A few species commonly classed as woody are more herbaceous than most shrubs and hence more tender; top should be cut to the ground each spring and treated more as hardy perennials. Among these are the following:

Buddleia Davidii.
Buddleia Lindleyana.
Caryopteris incana.
Coronilla Emerus.

Leopedeza bicolor.
Stephanandra incisa.
Vitex Agnus-castus.

Trailing and climbing vines.

**Actinidia arguta*.
 **Akebia quinata*.
 **Ampelopsis heterophylla* var. *amurensis*.
Aristolochia macrophylla.
 **Aristolochia tomentosa*.
 **Bignonia capreolata*.
Campsis radicans.
Celastrus orbiculatus.
Celastrus scandens.
Clematis Flammula.
Clematis lanuginosa var. [Henryi].
Clematis Jackmanii.
Clematis paniculata.
Clematis virginiana.
 **Evonymus radicans*.
 **Evonymus radicans* var. *vegeta*.
Forsythia suspensa.

Lonicera Caprifolium.
 **Lonicera japonica*.
 **Lonicera japonica* var. *aureo-reticulata*.
 **Lonicera japonica* var. *Halliana*.
Lonicera Periclymenum var. *belgica*.
Lonicera sempervirens.
Parthenocissus quinquefolia.
Parthenocissus quinquefolia var. *Engelmannii*.
 **Periploca græca*.
Vitis, native species.
Wisteria chinensis.
Wisteria magnifica.
Wisteria speciosa.

Shrubs suitable for hedges.

Berberis Thunbergii.
Berberis vulgaris.
Berberis vulgaris var. *atro-purpurea*.
Deutzia, all species listed.
Eleagnus multiflora.
Forsythia intermedia.
Hibiscus syriacus, in variety.
 **Hippophaë rhamnoides*.
Ligustrum, all listed species.

**Lonicera fragrantissima*.
Philadelphus, all species listed.
Ribes Gordonianum.
Ribes sanguineum.
Rhodotypos kerrioides.
Shepherdia argentea.
Spiræa Billardii.
Spiræa Van Houttei.
Tamarix, all species listed.

Shrubs for shady places.

Berberis Thunbergii.
Berberis vulgaris.
Berberis vulgaris var. *atro-purpurea*.
Ceanothus americanus.
Clethra alnifolia.
Cornus, all species.
Deutzia gracilis.
Deutzia Lemoinei.
Forsythia, all species.

Hydrangea arborescens.
Hypericum Moseianum.
Ligustrum, all species.
Lonicera Periclymenum.
Rhus canadensis.
Ribes sanguineum.
Rubus odoratus.
Viburnum acerifolium.
Viburnum dentatum.
Viburnum tomentosum.

Shrubs with twigs of striking color.

Cornus alba var. *cerifera*.
Cornus sanguinea.
Cornus stolonifera.
Cornus stolonifera var. *flaviramea*.

Eleagnus argentea.
Eleagnus multiflora.
 **Kerria japonica*.

Kinds with more or less conspicuous berries.

Berberis Thunbergii.
Berberis vulgaris.

**Evonymus alata*.
Evonymus americana.

Evonymus Bungeana.
Evonymus radicans var.
vegeta.
Ilex verticillata.
Ligustrum amurense.
Ligustrum Ibo var. *Regelianum.*
**Ligustrum ovalifolium.*
Lonicera Ledebourii.
Lonicera Morrowi.
Lonicera Ruprechtianum.

Rhamnus cathartica.
Rhamnus Frangula.
Rhus glabra.
Rhus typhina.
Sambucus, all species listed.
Sorbus arbutifolia.
Sorbus melanocarpa.
Staphylea trifolia.
Symphoricarpos albus.
Symphoricarpos orbiculatus.
Viburnum.

H. C. IRISH.

Shrubs and climbers for the South.

Owing to the great diversity of soil, elevation, and climatic conditions found in the Mountain, Piedmont, and Coastal zones of the South, it is impossible to make or to give an absolutely accurate list of deciduous and broad-leaved shrubs and climbers adapted to the three above-mentioned zones. The planter must, therefore, make due allowances for local conditions.

1. *Piedmont Zone* extends from the Mountain Zone to the Fall Line, which follows approximately the following cities: Weldon and Raleigh, North Carolina, Camden, and Columbia, South Carolina; Augusta, Milledgeville, Macon, and Columbus, Georgia; Montgomery, Alabama; Columbus and Holly Springs, Mississippi.

Deciduous shrubs for the Piedmont Zone.

Acanthopanax pentaphyllum.
Acer japonicum.
Æsculus octandra.
Amelanchier atropurpurea.
Amelanchier canadensis.
Amelanchier rotundifolia.
Amorpha canescens.
Amorpha fruticosa.
Amorpha glabra.
Amorpha tennesseensis.
Aralia chinensis var. *mandshurica.*
Aronia arbutifolia.
Aronia melanocarpa.
Asalea arborescens.
Asalea canadensis.
Asalea lutea.
Asalea mollis.
Asalea nudiflora.
Asalea pontica.
Asalea Vaseyi.
Asalea viscosa.
Baccharis halimifolia.
Bensoin æstivale.
Berberis aristata.
Berberis asiatica.
Berberis canadensis.
Berberis heteropoda.
Berberis Sieboldii.
Berberis sinensis.
Berberis Thunbergii.
Berberis vulgaris var. *atropurpurea.*
Buckleya distichophylla.
Buddleia Davidii.
Buddleia Davidii var. *magnifica.*
Buddleia intermedia.
Buddleia japonica.
Buddleia Lindleyana.
Buddleia officinalis.
Cæsalpinia Gilliesii.
Callicarpa americana.
Callicarpa purpurea.
Calycanthus fertilis.
Calycanthus florida.
Calycanthus occidentalis.
Caragana arborescens.
Caragana Chamlagu.
Caryopteris incana.
Cassia macrantha.
Ceanothus americanus.
Ceanothus hybridus.
Cephalanthus occidentalis.
Cercis chinensis.
Cercis Siliquastrum.
Chenomeles japonica.
Chilopsis saligna.
Clerodendron trichotomum.
Clethra alnifolia.

Colutea arborescens.
Comptonia asplenifolia.
Cornus alba.
Cornus alba var. *Spæthii.*
Cornus Amomum.
Cornus Mas.
Cornus racemosa.
Cornus rugosa.
Cornus sanguinea.
Cornus stolonifera.
Cornus stolonifera var. *flaviramea.*
Coronilla Emerus.
Corylopsis pauciflora.
Corylus americana.
Corylus Avellana.
Corylus Avellana var. *lacinata.*
Corylus maxima var. *purpurea.*
Corylus rostrata.
Cotoneaster acutifolia.
Cotoneaster multiflora.
Cotoneaster racemiflora.
Crataegus coccinea.
Crataegus Phænopryum.
Crataegus Oxyacantha.
Crataegus uniflora.
Cytisus præcox.
Cytisus scoparius.
Daphne Genkwa.
Daphne Mesereum.
Deutzia gracilis.
Deutzia Lemoinel.
Deutzia rosea.
Deutzia scabra.
Deutzia scabra var. *candidissima.*
Deutzia scabra var. *flore-pleno rosea.*
Deutzia scabra var. *Pride of Rochester.*
Deutzia Sieboldiana.
Diervilla florida.
Diervilla hybrida.



3056. English laurel.

Diervilla rivularis.
Diervilla semilifolia.
Direa palustris.
Elmagnus angustifolia.
Elmagnus argentea.
Elmagnus multiflora.
Elmagnus parvifolia.
Elmagnus umbellata.
Evonymus alata.
Evonymus americana.
Evonymus Bungeana.
Evonymus europæa.
Evonymus nana.
Evonymus patens.
Exochorda Korolkowii.
Exochorda racemosa.
Fontanesia Fortunei.
Fontanesia phylliroides.
Forestiera acuminata.
Forestiera ligustrina.
Foraythia intermedia.
Foraythia suspensa.
Foraythia suspensa var. *Fortunei.*
Foraythia viridissima.
Fothergilla Gardenii.
Fothergilla major.
Fothergilla parviflora.
Genista germanica.
Genista tinctoria.
Hallimodendron halodendron.
Hamamelis virginiana.
Hibiscus syriacus.
Hippophaë rhamnoides.
Hydrangea arborescens.
Hydrangea arborescens var. *sterilis.*
Hydrangea Hortensis.
Hydrangea paniculata.
Hydrangea paniculata var. *grandiflora.*
Hydrangea paniculata var. *præcox.*
Hydrangea quercifolia.
Hydrangea radiata.
Hypericum aureum.
Hypericum calycinum.
Hypericum densiflorum.
Hypericum glomeratum.
Hypericum lobocarpum.
Hypericum Moserianum.
Hypericum nudiflorum.
Hypericum prolificum.
Ilex decidua.
Ilex verticillata.
Indigofera Gerardiana.
Itea virginica.
Jasminum fruticans.
Jasminum humile.
Jasminum nudiflorum.
Jasminum officinale.
Kerria japonica.
Kerria japonica var. *argenteovariegata.*
Kerria japonica var. *flore-pleno.*
Lagerstroemia indica.
Lespedeza bicolor.
Lespedeza Sieboldii.
Ligustrum acuminatum.
Ligustrum amurense.
Ligustrum Ibo.
Ligustrum Ibo var. *Regelianum.*
Ligustrum ovalifolium.
Ligustrum vulgare.
Lonicera bella.
Lonicera fragrantissima.
Lonicera Morrowi.
Lonicera muscaviensis.
Lonicera pyrenaica.
Lonicera Ruprechtiana.
Lonicera spinosa.
Lonicera Standishii.
Lonicera tatarica.
Lonicera thibetica.
Lonicera Xylosteum.
Mertensia præcox.
Muehlenbeckia complexa.
Myrica carolinensis.
Myrica cerifera.
Myrica Gale.
Myricaria germanica.
Neviusia alabamensis.
Paliurus Spina-Christi.
Philadelphus Avalanche.
Philadelphus Mont Blanc.
Philadelphus coronarius.
Philadelphus coronarius var. *flore-pleno.*
Philadelphus Falconeri.
Philadelphus floridus.

Philadelphus gloriosus.
Philadelphus grandiflorus (coronarius var. ?)
Philadelphus hirsutus.
Philadelphus inodorus.
Philadelphus laxus.
Philadelphus Lemoinel.
Philadelphus Lewisii.
Philadelphus pubescens.
Photinia villosa.
Physocarpus opulifolius.



3057. A good use of woody vines.

Physocarpus opulifolius var. *aureus.*
Pieris mariana.
Poncirus trifoliata.
Potentilla fruticosa.
Prunus japonica.
Prunus maritima.
Prunus pumila.
Prunus triloba.
Punica Granatum.
Rhamnus cathartica.
Rhamnus Frangula.
Rhododendron canadense.
Rhodotypos kerrioides.
Rhus canadensis.
Rhus Michauxii.
Ribes curvatum.
Ribes nigrum.
Ribes sanguineum.
Robinia hispida.
Rosa blanda.
Rosa carolina.
Rosa rubiginosa.
Rosa rugosa.
Rosa setigera.
Roses, Bourbon.
Roses, Brier and Pensance Sweetbriers.
Roses, Hybrid Perpetual.
Roses, Hybrid Tea.
Roses, Japanese.
Roses, Monthly or China.
Roses, Moss.
Roses, Polyantha.
Roses, Tea.
Rosemarinus officinalis.
Rubus laciniatus.
Salix discolor.
Salix Greggii.
Salvia Greggii var. *alba.*
Spartium junceum.
Spiræa alba.
Spiræa albiflora.
Spiræa arguta.
Spiræa Billardii.
Spiræa Billardii var. *longipedunculata.*
Spiræa blanda.
Spiræa Bumalda.
Spiræa cantoniensis.
Spiræa cantoniensis flore-pleno.
Spiræa Douglasii.
Spiræa Fontenayii.
Spiræa Fortunei var. *semperflorens.*
Spiræa Froeblii.
Spiræa japonica.
Spiræa macrophylla.
Spiræa nipponica.
Spiræa prunifolia.
Spiræa prunifolia flore-pleno.

Spiraea revirescens.
Spiraea Schinabeckii.
Spiraea Thunbergii.
Spiraea tomentosa.
Spiraea trilobata.
Spiraea Van Houttei.
Spiraea virginiana.
Staphylea Bumalda.
Staphylea colchica.
Staphylea pinnata.
Staphylea trifolia.
Stephanandra incisa.
Stewartia pentagyna.
Styrax americana.
Styrax japonica.
Styrax Obassia.
Symphoricarpos albus.
Symphoricarpos microphyllus.
Symphoricarpos occidentalis.
Symphoricarpos orbiculatus.
Syringa chinensis.
Syringa Josikea.
Syringa pekinensis.
Syringa persica.

Vines for the Piedmont Zone.

Actinidia arguta.
Actinidia chinensis.
Actinidia Kolomitka.
Akebia lobata.
Akebia quinata.
Ampelopsis arborea.
Antigonon leptopus.
Aristolochia macrophylla.
Berchemia racemosa.
Bignonia capreolata.
Campsis chinensis.
Campsis hybrida.
Campsis, Mme. Gallen.
Campsis radicans.
Celastrus orbiculatus.
Clematis apiifolia.
Clematis crispa.
Clematis Flammula.
Clematis hybrida.
Clematis texensis.
Clematis Viorna.
Clematis virginiana.
Decumaria barbara.
Dioscorea Batatas.
Elaeagnus reflexa.
Evonymus radicans.
Evonymus radicans var. variegata.
Evonymus radicans var. vegeta.
Ficus pumila.
Gelsemium sempervirens.
Gelsemium sempervirens flore-pleno.
Hedera canariensis.
Hedera helix.
Humulus Lupulus.
Hydrangea petiolaris.

Broad-leaved evergreens for the Piedmont Zone.

Abelia floribunda.
Abelia grandiflora.
Arbutus Uedo.
Ardisia crenulata var. rubra.
Aucuba japonica.
Aucuba japonica var. latimaculata.
Azalea amona.
Azalea indica.
Azalea indica Kaempferi (Sargent's hybrida).
Azalea obtusa.
Berberis buxifolia.
Berberis Darwinii.
Berberis hakeoides.
Berberis ilicifolia.
Berberis Neubertii.
Berberis Sargentiana.
Berberis stenophylla.
Buxus japonica var. aurea.
Buxus sempervirens.
Buxus sempervirens var. Handworthii.
Buxus sempervirens var. suffruticosa.
Callistemon lanceolatus.
Calluna vulgaris.
Calluna vulgaris var. alba.
Camellia japonica.
Cleyera ochracea.
Cotoneaster horizontalis.
Cotoneaster microphylla.
Cotoneaster microphylla var. glacialis.
Cotoneaster rotundifolia.

Syringa villosa.
Syringa vulgaris.
Tamarix gallica.
Tamarix gallica var. indica.
Tamarix juniperina.
Tamarix odesana.
Tamarix parviflora.
Vaccinium arboreum.
Vaccinium corymbosum.
Viburnum dentatum.
Viburnum dilatatum.
Viburnum Lantana.
Viburnum macrocephalum.
Viburnum macrocephalum var. sterile.
Viburnum nudum.
Viburnum Opulus.
Viburnum Opulus var. nanum.
Viburnum Opulus var. sterile.
Vitex Agnus-castus.
Vitex incisa.
Xanthorrhiza apiifolia.
Zenobia speciosa.

Kadsura japonica.
Lonicera americana.
Lonicera chinensis.
Lonicera lobata.
Lonicera glaucescens.
Lonicera Heckrottii.
Lonicera japonica.
Lonicera japonica var. aureoreticulata.
Lonicera Periclymenum var. belgica.
Lonicera prolifera.
Lonicera sempervirens.
Lonicera Vilmorinii.
Menispermum canadense.
Parthenocissus Henryana.
Parthenocissus quinquefolia.
Parthenocissus quinquefolia var. Engelmannii.
Parthenocissus tricuspidata var. Veitchii.
Passeiflora caerulea.
Periploca graeca.
Polygonum baldschuanicum.
Pueraria hirsuta.
Solanum jasminoides var. grandiflorum.
Trachelospermum jasminoides.
Vitis aestivalis.
Vitis cordifolia.
Vitis Labrusca.
Vitis rotundifolia.
Wisteria chinensis.
Wisteria chinensis var. alba.
Wisteria chinensis flore-pleno.
Wisteria multijuga.
Wisteria speciosa.

Cotoneaster rotundifolia var. lanata.
Cotoneaster Simonsii.
Cotoneaster thymifolia.
Daphne Cneorum.
Elaeagnus macrophylla.
Elaeagnus pungens.
Elaeagnus pungens var. Simoni.
Elaeagnus variegata.
Eriobotrya japonica.
Escallonia montevidensis.
Escallonia virgata.
Evonymus japonica.
Evonymus japonica var. aureovariegata.
Evonymus japonica var. microphylla.
Fuchsia corallina.
Fuchsia gracilis.
Gardenia jasminoides.
Gardenia jasminoides var. Fortuniana.
Gardenia jasminoides var. radicans.
Gardenia jasminoides var. Veitchii.
Ilex Aquifolium.
Ilex Aquifolium var. aureoregina.
Ilex Aquifolium var. ferox.
Ilex crenata.
Ilex glabra.
Ilex integra.
Ilex latifolia.
Ilex vomitoria.

Illicium anisatum.
Ixora chinensis.
Kalmia angustifolia.
Kalmia latifolia.
Laurus nobilis.
Leiophyllum buxifolium.
Leucothoe Catesbaei.
Leucothoe populifolia.
Ligustrum coriaceum.
Ligustrum excelsum superbum.
Ligustrum japonicum.
Ligustrum lucidum.
Ligustrum macrophyllum.
Ligustrum marginatum aureum.
Ligustrum nepalense.
Ligustrum Quihoui.
Ligustrum sinense.
Mahonia Aquifolium.
Mahonia japonica.
Mahonia repens.
Mahonia pinnata.
Michelia fuscata.
Myrtus communis.
Nandina domestica.
Nerium.
Osmanthus Aquifolium.
Osmanthus fragrans.
Osmanthus Fortunei.
Pernettya mucronata.
Pernettya speciosa.
Phillyrea angustifolia.
Phillyrea decora.

Photinia serrulata.
Pieris floribunda.
Pieris japonica.
Pittosporum Tobira.
Prunus caroliniana.
Prunus Laurocerasus var. schipkaensis.
Prunus lusitanica.
Pyracantha coccinea.
Pyracantha coccinea var. Landii.
Raphiolepis indica.
Rhododendron arboreum.
Rhododendron arbutifolium.
Rhododendron catawbiense.
Rhododendron catawbiense hybridum.
Rhododendron maximum.
Rhododendron myrtifolium.
Rhododendron ponticum.
Rhododendron punctatum.
Skimmia japonica.
Thea sinensis.
Veronica Traversii.
Viburnum odoratissimum.
Viburnum suspensum.
Viburnum Tinus.
Yucca filamentosa.
Yucca glauca.
Yucca gloriosa.
Yucca Treculeana.



3058. *Berberis Thunbergii.*

2. *Coastal Zone* extends from the Fall Line, as outlined under the Piedmont Zone, to the Atlantic Ocean and Gulf of Mexico, but exclusive of that part of Florida south of a line drawn across the state to St. Augustine and Cedar Keys.

Deciduous shrubs for the Coastal Zone.

Acacia Farnesiana.
Acanthopanax pentaphyllum.
Aesculus octandra.
Aesculus Pavia.
Amelanchier rotundifolia.
Amorpha canescens.
Amorpha fruticosa.
Aronia arbutifolia.
Azalea arborecens.
Azalea lutes.
Azalea nudiflora.
Azalea viscosa.
Berberis aristata.
Berberis sinensis.
Berberis Thunbergii.
Berberis vulgaris.
Berberis vulgaris var. atropurpurea.
Buddleia Davidii.
Buddleia Davidii var. magnifica.
Buddleia intermedia.
Buddleia japonica.
Buddleia Lindleyana.
Buddleia officinalis.
Ceanalpinia Pilleisii.
Callicarpa americana.
Callicarpa purpurea.
Calycanthus fertilis.
Calycanthus florida.
Calycanthus occidentalis.
Caryopteris incana.
Cassia macrantha.
Ceanothus americanus.
Ceanothus hybridus.
Cephalanthus occidentalis.
Cercis japonica.
Cercis Siliquastrum.
Chenomeles japonica.
Chilopsis saligna.
Clerodendron trichotomum.
Clethra alnifolia.
Cornus alba.
Cornus Amomum.
Cornus sanguinea.
Coronilla Emerus.
Corylus americana.
Cotoneaster multiflora.
Cotoneaster racemiflora.
Deutsia rosea.
Deutsia Lemoinei.
Deutsia scabra var. candidissima.
Deutsia scabra var. flore-pleno rosea.
Deutsia scabra, Pride of Rochester.
Deutsia Sieboldiana.
Diervilla florida.
Diervilla hybrida.
Dirca palustris.
Elaeagnus angustifolia.
Elaeagnus multiflora.
Elaeagnus parvifolia.
Elaeagnus umbellata.
Erythrina Crista-galli.
Evonymus alata.
Evonymus americana.
Evonymus europaea.
Evonymus nana.
Evonymus patens.
Exochorda Korolkowii.
Exochorda racemosa.
Fontanesia Fortunei.
Fontanesia phylliroides.
Forsythia intermedia.
Forsythia suspensa.
Forsythia suspensa var. Fortunei.
Forsythia viridissima.
Halimodendron halodendron.
Hamamelis virginiana.
Hibiscus syriacus.
Hippophae rhamnoides.
Hydrangea arborecens.

Hydrangea arborescens var. *sterilis*.
Hydrangea Hortensis.
Hydrangea quercifolia.
Hypericum calycinum.
Hypericum densiflorum.
Hypericum glomeratum.
Hypericum lobocarpum.
Hypericum Moserianum.
Hypericum prolificum.
Ilex decidua.
Ilex verticillata.
Indigofera Gerardiana.
Itea virginica.
Jasminum fruticans.
Jasminum humile.
Jasminum nudiflorum.
Jasminum officinale.
Kerria japonica.
Kerria japonica var. *argenteo-variegata*.
Kerria japonica var. *flore-pleno*.
Lagerstræmia indica.
Lespedeza bicolor.
Lespedeza Sieboldii.
Ligustrum acuminatum.
Ligustrum amurense.
Ligustrum Ibo.
Ligustrum Ibo var. *Regelianum*.
Ligustrum ovalifolium.
Ligustrum vulgare.
Lonicera bella.
Lonicera fragrantissima.
Lonicera gracilipes.
Lonicera Morrowii.
Lonicera Ruprechtiana.
Lonicera Standishii.
Lonicera tatarica.
Lycium halimifolium.
Myrica præcox.
Myrica carolinensis.
Myrica cerifera.
Myricaria germanica.
Neviusia alabamensis.
Paliurus Spina-Christi.
Philadelphus coronarius var. *flore-pleno*.
Philadelphus grandiflorus (coronarius var.).
Philadelphus inodorus.
Philadelphus pubescens.
Philadelphus laxus.
Philadelphus Lemoini.
Philadelphus Lewisii.
Philadelphus pubescens.
Philadelphus Avalanche.
Physocarpus opulifolius.
Poncirus trifoliata.
Potentilla fruticosa.
Prunus japonica.
Prunus maritima.
Prunus pumila.
Prunus triloba.
Punica granatum.
Rhamnus cathartica.
Rhodotypos kerrioides.
Rhus canadensis.

Vines for the Coastal Zone.

Akebia quinata.
Akebia lobata.
Ampelopsis arborea.
Ampelopsis heterophylla var. *elegans*.
Antigonon leptopus.
Berchemia racemosa.
Bignonia capreolata.
Campsis chinensis.
Campsis hybrida.
Campsis Mmc. Gallen.
Campsis radicans.
Clematis crispa.
Clematis Flammula.
Clematis paniculata.
Clematis texensis.
Decumaria barbara.
Dioscorea Batatas.
Elæagnus reflexa.
Evonymus radicans.
Evonymus radicans var. *variegata*.
Ficus pumila.
Gelsemium sempervirens.
Gelsemium sempervirens flore-pleno.
Hedera canariensis.
Hedera helix.
Jasminum primulinum.

Rhus Michauxii.
Ribes curvatum.
Robinia hispida.
Rosmarinus officinalis.
Rosa carolina.
Rosa rugosa.
Rosa setigera.
Roses, Bourbon.
Roses, Brier and Pensance.
Sweetbriers.
Roses, Hybrid Perpetual.
Roses, Hybrid Tea.
Roses, Japanese.
Roses, Monthly or China.
Roses, Polyantha.
Roses, Tea.
Rubus laciniatus.
Salix incana.
Salix sericea.
Salvia Greggii.
Salvia Greggii var. *alba*.
Sambucus canadensis.
Sambucus nigra.
Sambucus nigra var. *laciniata*.
Spartium junceum.
Spiræa albiflora.
Spiræa arguta.
Spiræa Billardii.
Spiræa blanda.
Spiræa Bumalda.
Spiræa cantonensis.
Spiræa cantonensis flore-pleno.
Spiræa Douglasii.
Spiræa Fontenaysii.
Spiræa Fortunei var. *semperflorens*.
Spiræa Froebelii.
Spiræa japonica.
Spiræa macrophylla.
Spiræa prunifolia.
Spiræa prunifolia flore-pleno.
Spiræa revirescens.
Spiræa Thunbergii.
Spiræa Van Houttei.
Stephanandra incisa.
Stewartia pentagyna.
Styrax americana.
Styrax japonica.
Symphoricarpos microphyllus.
Symphoricarpos orbiculatus.
Syringa chinensis.
Syringa pekinensis.
Syringa persica.
Tamarix gallica.
Tamarix gallica var. *indica*.
Tamarix juniperina.
Tamarix hispida var. *æstivalis*.
Tamarix odessana.
Tamarix parviflora.
Viburnum macrocephalum.
Viburnum nudum.
Viburnum Opulus var. *sterile*.
Vitex Agnus-cæstus.
Vitex incisa.
Zenobia speciosa.

Kadsura japonica.
Lonicera americana.
Lonicera chinensis.
Lonicera flava.
Lonicera glaucescens.
Lonicera Heckrottii.
Lonicera japonica.
Lonicera japonica var. *aureo-reticulata*.
Lonicera Periclymenum var. *belgica*.
Lonicera prolifera.
Lonicera sempervirens.
Lonicera Vilmorinii.
Parthenocissus Henryana.
Parthenocissus quinquefolia.
Parthenocissus quinquefolia var. *Engelmannii*.
Parthenocissus tricuspidata var. *Veitchii*.
Passiflora cærulea.
Periploca græca.
Polygonum baldschuanicum.
Pueraria hirsuta.
Pyrostegia venusta.
Solanum jasminoides var. *grandiflorum*.
Trachelospermum jasminoides.
Vitis æstivalis.

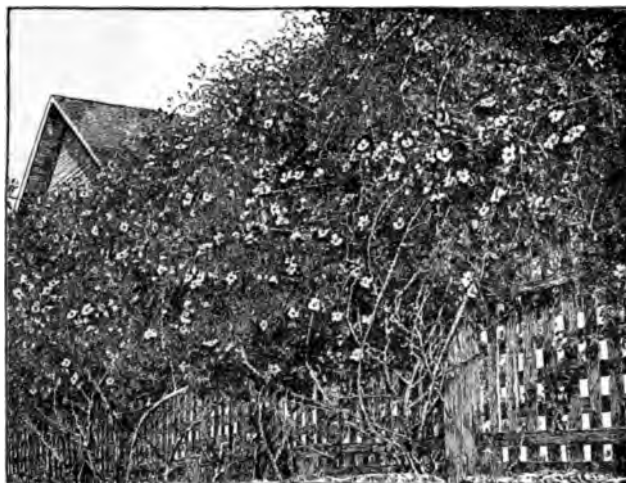
Vitis cordifolia.
Vitis rotundifolia.
Wisteria chinensis.
Wisteria chinensis var. *alba*.

Wisteria chinensis var. *flore-pleno*.
Wisteria multijuga.
Wisteria speciosa.

Broad-leaved evergreens for the Coastal Zone.

Abelia floribunda.
Abelia grandiflora.
Arbutus Unedo.
Ardisia crenulata var. *rubra*.
Azalea amoena.
Azalea indica.
Azalea obtusa.

Ilex integra.
Ilex latifolia.
Ilex vomitoria.
Illicium anisatum.
Ixora chinensis.
Kalmia latifolia.
Laurus nobilis.



3059. A Cherokee rose cover, in the South.

Berberis buxifolia.
Berberis Darwinii.
Berberis ilicifolia.
Berberis Neubertii.
Berberis stenophylla.
Buxus japonica var. *aurea*.
Buxus sempervirens.
Buxus sempervirens var. *Hand-worthii*.
Buxus sempervirens var. *suffruticosa*.
Callistemon lanceolatus.
Camellia japonica.
Cleyera ochracea.
Cotoneaster horizontalis.
Cotoneaster microphylla.
Cotoneaster microphylla var. *glacialis*.
Cotoneaster rotundifolia.
Cotoneaster rotundifolia var. *lanata*.
Cotoneaster Simonsii.
Cotoneaster thymifolia.
Elæagnus macrophylla.
Elæagnus pungens.
Elæagnus pungens var. *Simoni*.
Elæagnus variegata.
Eriobotrya japonica.
Escallonia virgata.
Escallonia montevidensis.
Evonymus japonica.
Evonymus japonica var. *aureo-variegata*.
Evonymus japonica var. *microphylla*.
Fuchsia corallina.
Fuchsia gracilis.
Gardenia jasminoides.
Gardenia jasminoides var. *Fortuniana*.
Gardenia jasminoides var. *radi-cans*.
Gardenia jasminoides var. *Veitchii*.
Ilex cornuta.
Ilex crenata.
Ilex glabra.

Leiophyllum buxifolium.
Leucothoe Catebaei.
Leucothoe populifolia.
Leucothoe racemosa.
Ligustrum excelsum superbum.
Ligustrum japonicum.
Ligustrum lucidum.
Ligustrum macrophyllum.
Ligustrum marginatum aureum.
Ligustrum nepalense.
Ligustrum Quihoui.
Ligustrum sinense.
Mahonia Aquifolium.
Mahonia japonica.
Michelia fuscata.
Myrtus communis.
Nandina domestica.
Nerium.
Osmanthus Aquifolium.
Osmanthus Fortunei.
Osmanthus fragrans.
Pernettya mucronata.
Pernettya speciosa.
Phillyrea angustifolia.
Phillyrea decora.
Photinia serrulata.
Pieris floribunda.
Pieris japonica.
Pittosporum Tobira.
Prunus caroliniana.
Prunus Laurocerasus.
Prunus Laurocerasus var. *schipkaensis*.
Prunus lusitanica.
Pyracantha coccinea.
Pyracantha coccinea var. *Lalandii*.
Raphiolepis indica.
Thea sinensis.
Viburnum odoratissimum.
Viburnum suspensum.
Viburnum Tinus.
Yucca aloifolia.
Yucca filamentosa.
Yucca gloriosa.
Yucca Trecaleana.

3. *Mountain or Upper Zone* includes all that territory above Harper's Ferry, Maryland; Roanoke, Virginia; Winston-Salem, Morganton, and Rutherfordton, North Carolina; Spartanburg and Pendleton, South Carolina;

Gainesville and Cartersville, Georgia; Huntsville, Alabama; Murfreesboro, Tennessee, and thence north to the Kentucky line.

Deciduous shrubs for the Mountain or Upper Zone

Acanthopanax pentaphyllum.
Acer japonica.
Aesculus octandra.
Aesculus Pavia.
Amelanchier atropurpurea.
Amelanchier canadensis.
Amelanchier rotundifolia.
Amorpha canescens.
Amorpha fruticosa.
Amorpha glabra.
Amorpha tennesseensis.
Aralia chinensis var. mand-
schurica.
Aronia arbutifolia.
Aronia melanocarpa.
Ascyrum hypericoides.
Baccharis halimifolia.
Benzoin aestivale.
Berberis asiatica.
Berberis canadensis.
Berberis heteropoda.
Berberis Sieboldii.
Berberis sinensis.
Berberis Thunbergii.
Berberis vulgaris.
Berberis vulgaris var. atro-
purpurea.
Buckleya distichophylla.
Buddleia Davidii var. magnifica.
Buddleia intermedia.
Buddleia japonica.
Buddleia Lindleyana.
Callicarpa americana.
Callicarpa purpurea.
Calycanthus fertilis.
Calycanthus florida.
Calycanthus occidentalis.
Caragana arborescens.
Caragana Chamisso.
Ceanothus americanus.
Ceanothus Fendleri.
Ceanothus hybridus.
Cephalanthus occidentalis.
Cercis chinensis.
Cercis Siliquastrum.
Chenomeles japonica.
Chilopsis saligna.
Clerodendron trichotomum.
Clethra alnifolia.
Colutea arborescens.
Comptonia asplenifolia.
Cornus alba.
Cornus alba var. Spaethii.
Cornus Anomum.
Cornus mas.
Cornus racemosa.
Cornus rugosa.
Cornus sanguinea.
Cornus stolonifera.
Cornus stolonifera var. flavi-
ramea.
Coronilla Emerus.
Corylopsis pauciflora.
Corylus americana.
Corylus Avellana.
Corylus Avellana var. laciniata.
Corylus maxima var. purpurea.
Corylus rostrata.
Cotoneaster acutifolia.
Cotoneaster multiflora.
Cotoneaster racemiflora.
Crataegus coccinea.
Crataegus Oxyacantha.
Crataegus Phaeopyrum.
Cytisus praecox.
Cytisus scoparius.
Daphne Mesereum vars. alba
and rubra.
Daphne Genkwa.
Deutzia gracilis.
Deutzia Lemoinei.
Deutzia rosea.
Deutzia scabra.
Deutzia scabra var. candida-
sima.
Deutzia scabra var. plena.
Deutzia scabra, Pride of
Rochester.
Deutzia Sieboldiana.
Diervilla florida.
Diervilla hybrida.
Diervilla rivularis.
Diervilla sessilifolia.
Dirca palustris.

Elaeagnus angustifolia.
Elaeagnus argentea.
Elaeagnus multiflora.
Elaeagnus parvifolia.
Elaeagnus umbellata.
Evonymus alata.
Evonymus americana.
Evonymus Bungeana.
Evonymus europaea.
Evonymus Maackii.
Evonymus nana.
Evonymus patens.
Exochorda Korolkowii.
Exochorda racemosa.
Fontanesia Fortunei.
Fontanesia phyllisoides.
Forestiera acuminata.
Forestiera ligustrina.
Forsythia intermedia.
Forsythia suspensa.
Forsythia suspensa var. For-
tunei.
Forsythia viridissima.
Fothergilla Gardenii.
Fothergilla major.
Fothergilla parviflora.
Genista germanica.
Genista tinctoria.
Halimodendron halodendron.
Hamamelis virginiana.
Hibiscus syriacus.
Hippophae rhamnoides.
Holidiscus discolor.
Hydrangea arborescens.
Hydrangea arborescens var.
sterilis.
Hydrangea Hortensia.
Hydrangea paniculata.
Hydrangea paniculata var.
grandiflora.
Hydrangea paniculata var. pra-
cox.
Hydrangea quercifolia.
Hydrangea radiata.
Hypericum aureum.
Hypericum calycinum.
Hypericum densiflorum.
Hypericum glomeratum.
Hypericum lobocarpum.
Hypericum Moserianum.
Hypericum nudiflorum.
Hypericum prolificum.
Ilex decidua.
Ilex verticillata.
Indigofera Gerardiana.
Itea virginica.
Jasminum fruticans.
Jasminum humile.
Jasminum nudiflorum.
Jasminum officinale.
Kerria japonica.
Kerria japonica var. argenteo-
variegata.
Kerria japonica flore-pleno.
Lagerstromia indica.
Lespedeza bicolor.
Lespedeza Sieboldii.
Leucothoe racemosa.
Leucothoe recurva.
Ligustrum acuminatum.
Ligustrum amurense.
Ligustrum Ibo.
Ligustrum Ibo var. Regel-
ianum.
Ligustrum ovalifolium.
Ligustrum vulgare.
Lonicera bella.
Lonicera fragrantissima.
Lonicera gracilipes.
Lonicera Morrowii.
Lonicera muscaviensis.
Lonicera pyrenaica.
Lonicera Ruprechtiana.
Lonicera spinosa.
Lonicera Standishii.
Lonicera tatarica.
Lonicera tibetica.
Lonicera Xylosteum.
Lycium vulgare.
Lyonia ligustrina.
Menziesia pilosa.
Meratia praecox.
Muehlenbeckia complexa.
Myrica carolinensis.

Myrica cerifera.
Myrica Gale.
Myricaria germanica.
Neviusia alabamensis.
Paliurus Spina-Christi.
Philadelphus coronarius.
Philadelphus coronarius var.
flore-pleno.
Philadelphus Falconeri.
Philadelphus floridus.
Philadelphus gloriosus.
Philadelphus grandiflorus (cor-
onarius var.).
Philadelphus hirsutus.
Philadelphus inodorus.
Philadelphus laxus.
Philadelphus Lemoinei.
Philadelphus Lewisii.
Philadelphus pubescens.
Philadelphus Avalanche.
Philadelphus, Mont Blanc.
Photinia villosa.
Physocarpus opulifolius.
Physocarpus opulifolius var.
aureus.
Pieris mariana.
Poncirus trifoliata.
Potentilla fruticosa.
Prunus Besseyi.
Prunus incana.
Prunus japonica.
Prunus maritima.
Prunus pumila.
Prunus triloba.
Punica Granatum.
Rhamnus cathartica.
Rhamnus Frangula.
Rhododendron arborescens.
Rhododendron canadense.
Rhododendron gandavensis.
Rhododendron japonicum.
Rhododendron luteum.
Rhododendron nudiflorum.
Rhododendron ponticum.
Rhododendron Vaseyi.
Rhododendron viscosum.
Rhodotypos kerrioides.
Rhus canadensis.
Rhus Michauxii.
Ribes aureum.
Ribes curvatum.
Ribes Cynosbati.
Ribes glandulosum.
Ribes Gordonianum.
Ribes nigrum.
Ribes rotundifolium.
Ribes sanguineum.
Robinia hispida.
Rosa alpina.
Rosa blanda.
Rosa carolina.
Rosa rubiginosa.
Rosa rugosa.
Rosa setigera.
Roses, Bourbon.
Roses, Brier and Pensancee
Sweetbriars
Roses, Hybrid Perpetual.
Roses, Hybrid Tea.
Roses, Japanese.
Roses, Monthly or China.
Roses, Moss.
Roses, Polyantha.
Roses, Tea.
Rosmarinus officinalis.
Rubus laciniatus.
Rubus odoratus.
Rubus parviflorus.
Rubus roseiflorus.
Salix discolor.
Salix humilis.
Salix incana.
Salix lucida.
Salix sericea.
Salix tristis.
Sambucus canadensis.
Sambucus nigra.
Sambucus nigra var. laciniata.
Sambucus pubens.
Shepherdia argentea.
Spartium junceum.
Spiraea alba.
Spiraea albiflora.
Spiraea arguta.
Spiraea bethlehemensis var.
rubra.
Spiraea Billardii.
Spiraea Billardii var. longi-
pedunculata.
Spiraea blanda.
Spiraea Bumalda.
Spiraea californica.
Spiraea cantonensis.
Spiraea cantonensis flore-
pleno.
Spiraea crenata.
Spiraea Douglasii.
Spiraea eximia.
Spiraea Fontenaysii.
Spiraea Fortunei var. semper-
florens.
Spiraea Froebellii.
Spiraea japonica.
Spiraea Lennesana.
Spiraea macrophylla.
Spiraea Margarita.
Spiraea Mensiesii.
Spiraea nipponica.
Spiraea prunifolia.
Spiraea prunifolia flore-pleno.
Spiraea Schinabeckii.
Spiraea Thunbergii.
Spiraea trilobata.
Spiraea Van Houttei.
Spiraea revirescens.
Spiraea syringiflora.
Spiraea tomentosa.
Spiraea virginiana.
Staphylea Bumalda.
Staphylea colchica.
Staphylea pinnata.
Staphylea trifolia.
Stephanandra incisa.
Stephanandra Tanaka.
Stewartia pentagyna.
Stewartia Pseudo-Camellia.
Styrax americana.
Styrax japonica.
Styrax Obassia.
Symphoricarpos albus.
Symphoricarpos microphyllus.
Symphoricarpos occidentalis.
Symphoricarpos orbiculatus.
Symphoricarpos ovatus.
Syringa chinensis.
Syringa Josikea.
Syringa pekinensis.
Syringa perica.
Syringa villosa.
Syringa vulgaris.
Syringa vulgaris, named sorts.
Tamarix gallica.
Tamarix gallica var. indica.
Tamarix hispida var. aestivalis.
Tamarix juniperina.
Tamarix Odessana.
Tamarix parviflora.
Ulex europaeus.
Ulex nanus.
Vaccinium corymbosum.
Vaccinium pallidum.
Vaccinium pennsylvanicum.
Viburnum acerifolium.
Viburnum alnifolium.
Viburnum cassinoides.
Viburnum dentatum.
Viburnum dilatatum.
Viburnum Lantana.
Viburnum macrocephalum.
Viburnum macrocephalum var.
sterile.
Viburnum nudum.
Viburnum Opulus.
Viburnum Opulus var.
nanum.
Viburnum Opulus var. sterile.
Viburnum Sieboldii.
Viburnum tomentosum.
Viburnum tomentosum var.
plenum.
Vitis Agnus-castus.
Vitis indica.
Xanthorrhiza apiifolia.
Zenobia speciosa.

Vines for the Mountain Zone.

Actinidia arguta.
Actinidia Kolomikta.
Akebia lobata.
Akebia quinata.
Ampelopsis arborea.
Ampelopsis cordata.

Ampelopsis heterophylla.
Ampelopsis heterophylla var.
elegans.
Aristolochia macrophylla.
Berchemia racemosa.
Bigonia caprolata.

Brunnibolia cirrhosa (a somewhat shrubby, tendril-climbing plant native in eastern United States; allied to *Polygonella*).
Campsis chinensis.
Campsis hybrida.
Campsis, Mme. Gallen.
Campsis radicans.
Celastrus orbiculatus.
Celastrus scandens.
Clematis apifolia.
Clematis crispa.
Clematis flammula.
Clematis hybrida.
Clematis montana.
Clematis orientalis.
Clematis paniculata.
Clematis Viora.
Clematis virginiana.
Clematis Vitalba.
Decumaria barbara.
Eleagnus reifera.
Evonymus radicans.
Evonymus radicans var. *variegata*.
Evonymus radicans var. *virgata*.
Gelsemium sempervirens.
Hedera helix.
Humulus Lupulus.
Hydrangea petiolaris.
Lonicera americana.

Lonicera chinensis.
Lonicera crucea.
Lonicera flava.
Lonicera glaucescens.
Lonicera Heckrottii.
Lonicera japonica.
Lonicera japonica var. *aureo-reticulata*.
Lonicera Periclymenum var. *belgica*.
Lonicera prolifera.
Lonicera sempervirens.
Lonicera Vilmorinii.
Menispermum canadense.
Parthenocissus quinquefolia.
Parthenocissus quinquefolia var. *Engelmannii*.
Parthenocissus tricuspidata var. *Veitohii*.
Periploca græca.
Polygonum dillnode.
Pueraria hirsuta.
Vitis aestivalis.
Vitis cordifolia.
Vitis Labrusca.
Vitis rotundifolia.
Wisteria chinensis.
Wisteria chinensis var. *alba*.
Wisteria chinensis flore-pleno.
Wisteria multijuga.
Wisteria speciosa.

Broad-leaved evergreens for the Mountain Zone.

Abelia grandiflora.
Andromeda polifolia.
Aretostaphylos Uva-ursi.
Azalea amona.
Azalea indica (hardy sorts).
Azalea indica Kaempferi (Sargent's hybrids).
Azalea obtusa.
Berberis hakeoides.
Berberis ilicifolia.
Berberis Neubertii.
Berberis Sargentiana.
Buxus japonica var. *aurea*.
Buxus sempervirens.
Buxus sempervirens var. *Handworthii*.
Buxus sempervirens var. *suffruticosa*.
Calluna vulgaris.
Calluna vulgaris var. *alba*.
Chamaedaphne calyculata.
Cotoneaster horizontalis.
Cotoneaster microphylla.
Cotoneaster microphylla var. *glacialis*.
Cotoneaster rotundifolia.
Cotoneaster rotundifolia var. *lanata*.
Cotoneaster Simonii.
Cotoneaster thymifolia.
Daphne Blagayana.
Daphne Cneorum.
Eleagnus macrophylla.
Eleagnus variegata.
Ephedra distachya.
Erica carnea.
Erica stricta.
Erica Tetralix.
Erica vagana.
Evonymus japonica.
Evonymus japonica var. *aureo-variegata*.
Evonymus japonica var. *microphylla*.
Evonymus patens.
Ilex Aquifolium.
Ilex Aquifolium var. *aureo-regina*.
Ilex Aquifolium var. *ferox*.
Ilex Aquifolium var. *ferox variegata*.
Ilex Aquifolium var. *laurifolia*.
Ilex cornuta.

Ilex orenata.
Ilex glabra.
Ilex vomitoria.
Kalmia angustifolia.
Kalmia glauca.
Kalmia latifolia.
Leptophyllum buxifolium.
Leptophyllum buxifolium var. *prostratum*.
Leucothoe Catesbeii.
Leucothoe populifolia.
Ligustrum coriaceum.
Ligustrum japonicum.
Ligustrum lucidum.
Ligustrum macrophyllum.
Ligustrum nepalense.
Ligustrum Quihoui.
Ligustrum sinense.
Mahonia Aquifolium.
Mahonia japonica.
Mahonia pinnata.
Mahonia repens.
Nandina domestica.
Osmanthus Aquifolium.
Osmanthus Fortunei.
Phillyrea angustifolia.
Phillyrea decora.
Photinia serrulata.
Pieris floribunda.
Pieris japonica.
Prunus Laurocerasus.
Prunus Laurocerasus var. *schipkaensis*.
Prunus lusitanica.
Pyracantha coccinea.
Pyracantha coccinea var. *Lalandii*.
Rhododendron arboreum.
Rhododendron arbutifolium.
Rhododendron catawbiense.
Rhododendron catawbiense var. *hybridum*.
Rhododendron maximum.
Rhododendron myrtifolium.
Rhododendron punctatum.
Rhododendron ponticum.
Rhododendron Wilsonii.
Skimmia japonica.
Veronica Traversii.
Yucca filamentosa.
Yucca glauca.
Yucca gloriosa.
Yucca Treculeana.

L. A. BERCKMANS.

Ornamental shrubs for California.

No pretensions have been made in compiling the following list to include every plant of desirable ornamental characteristics that will grow in California. Many exotics are being continually introduced, some of which have proved highly satisfactory, while others are little known. The effort has been rather to classify

under various subheads those shrubs which are undoubtedly suited for the purpose indicated and which have proved themselves well adapted to the various sections of the state.

Many of the deciduous ornamental plants commonly employed in the eastern United States for landscape planting have purposely been omitted, as they fail to produce the same wonderful spring-flower effects under the different climatic conditions of California. Only such deciduous shrubs as bloom freely and seem to have become more or less adapted to the drier climate of this state are included.

Because of the great variety of climatic and soil conditions throughout the state, it has become necessary to think of it as divided into three general regions,—the interior valleys, the San Francisco Bay district, and that part of southern California in the vicinity of the coast.

Those kinds marked with a dagger (†) will thrive only in southern California; those with a star (*) will grow in the South and as far north on the coast as the San Francisco Bay region, while such kinds as have no abbreviation attached will probably grow in all the cultivated areas of the state, including the large interior valleys. With one exception, the shrubs in the lists are arranged in the order of their desirability for the purposes described by the subhead. By cross-reference, the lists should prove helpful in selecting species of certain characteristics for given climatic and cultural conditions to produce the results desired.

Group I. Shrubs which are more or less resistant to conditions created by full shade.

While the larger number of these shrubs will produce the best results in half-shade, or even in full sun if given sufficient water, they are more or less tolerant to conditions existing under live oak trees, in courts, or on the north sides of buildings.

Evergreen.

- Vaccinium ovatum* (3 feet).
- *Tree ferns in variety (6 to 10 feet).
- Aucuba japonica* (4 feet).
- **Coprosma Baueri* (6 feet).
- Evonymus* in variety (6 to 8 feet).
- Fatsia japonica* (6 feet).
- Mahonia* in variety (4 feet).
- Sollya heterophylla* (3 feet).
- †*Asystasia bella* (3 feet).
- Hypericum calycinum* (1 foot).
- Ligustrum* in variety (6 to 10 feet).
- Osmanthus* in variety (3 to 10 feet).
- Buxus sempervirens* (2 to 8 feet).
- **Abutilon striatum* (8 feet).
- Abelia grandiflora* (6 feet).
- Azalea indica* (4 feet).
- Hydrangea Hortensis* (5 feet).
- Nandina domestica* (6 feet).
- Berberis Darwinii* (5 feet).
- **Trachelospermum jasminoides* (3 feet).
- Jasminum humile* (6 feet).
- **Fuchsia* in variety (6 feet).
- Myrtus communis* (3 to 5 feet).
- **Myrtus Ugni* (4 feet).
- Eugenia apiculata* (8 feet).
- **Philadelphus mexicanus* (5 feet).
- Cotoneaster horizontalis* (2 to 3 feet).
- **Reinwardtia trigyna* (3 feet).

Deciduous.

- Symphoricarpos racemosus* (3 feet).
- Ribes speciosum* (3 feet).
- Azalea sinense* (3 feet).
- Kerria japonica* (6 feet).
- Chenomeles japonica* (6 feet).

Group II. Shrubs which thrive most successfully in half-shade in California.

Many plants will produce the best results in full sun if favorable moisture conditions can be maintained throughout the summer, but the amount of sun exposure that plants in this list will withstand depends largely

on the section of the state in which they are located and on the amount of water they receive. Because of neglect aided by the long dry season, they often do better, however, in half-shade where the soil does not dry out so rapidly.

Evergreen.

Daphne odora (3 feet).
Erica in variety (2 to 5 feet).
*Coprosma Baueri (6 feet).
*Philadelphus mexicanus (5 feet).
Abelia grandiflora (6 feet).
Sollya heterophylla (3 feet).
*Fuchsia in variety (6 feet).
Asara microphylla (8 feet).
Hydrangea Hortensia (5 feet).
Cotoneaster horizontalis (2 to 3 feet).
Camellia in variety (8 feet).
Hypericum calycinum (1 foot).
Hypericum Moserianum (3 feet).
Mahonia in variety (4 feet).
Fatsia japonica (6 feet).
*Abutilon striatum (8 feet).
*Trachelospermum jasminoides (3 feet).
Aucuba japonica (4 feet).
Nandina domestica (6 feet).
Escallonia rubra (6 feet).
Pittosporum Tobira (12 feet).
Pittosporum heterophyllum (3 feet).
†Cuphea in variety (2 feet).
†Clerodendron in variety (6 feet).
Buxus in variety (2 to 8 feet).
*Cestrum in variety (8 feet).
Cornus capitata (10 feet).
Azalea in variety (4 feet).
Rhododendron in variety (5 feet).
Osmanthus in variety (3 to 10 feet).
Michelia fuscata (6 feet).
Pyracantha crenulata (6 feet).
Viburnum Tinus var. lucidum (10 feet).
Garrya elliptica (8 feet).
Arbutus Menziesii (25 feet).
*Myrtus Ugni (4 feet).
Ilex Aquifolium (6 to 10 feet).
Maytenus Boaria (10 to 20 feet).
*Heliotropium in variety (4 feet).
*Plumbago capensis (4 feet).
*Statice in variety (2 feet).
Chorisia ilicifolia (5 feet).
Ternstroemia japonica (8 feet).
†Asystasia bella (3 feet).
*Tibouchina splendens (5 feet).
*Jacobinia in variety (3 feet).
†Strobilanthus Dyerianus (5 feet).
†Templetonia retusa (3 feet).
†Thevetia nereifolia (8 feet).
*Melianthus major (4 feet).
*Tree ferns in variety (6 to 10 feet).
Prunus Laurocerasus (8 to 10 feet).

Deciduous.

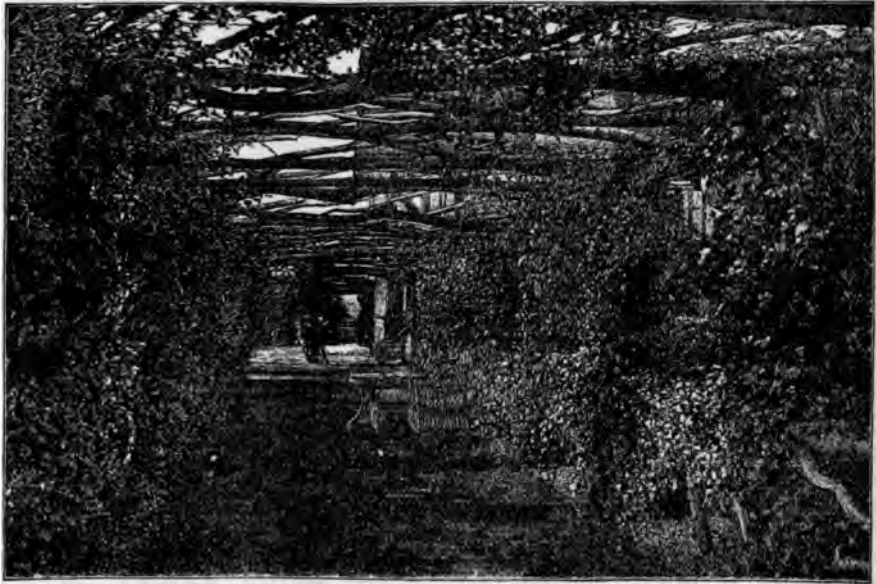
Chenomeles japonica (6 feet).
Diervilla in variety (8 feet).
Kerria japonica (6 feet).
Deutzia in variety (4 feet).
Berberis Thunbergii (3 feet).
Præonia suffruticosa (3 feet).
Rhododendron, Hinodigiri (3 feet).
Rhododendron sinense (3 feet).
Ribes in variety (6 to 8 feet).
Philadelphus in variety (6 feet).
Spiræa Van Houttei (4 feet).
Spiræa cantoniensis (5 feet).
Viburnum Opulus var. sterile (8 feet).
Viburnum tomentosum var. plicatum (6 feet).
Syringa in variety (6 to 10 feet).
Magnolia in variety (6 to 10 feet).

Group III. Shrubs which thrive most successfully in protected sunny locations.

Many plants, native of countries warmer than California, require warm moist situations.

Evergreen.

Acacia in variety (5 to 20 feet).
†Acoeanthera spectabilis (6 feet).
†Bauhinia in variety (8 to 10 feet).
Berberis Darwinii (6 to 8 feet).
†Bouvardia Humboldtii (5 feet).
*Buddleia Davidii var. Veitchiana (6 to 8 feet).
*Cantus buxifolia (8 feet).
*Carissa grandiflora (4 feet).
*Cassia in variety (4 to 10 feet).
Choisya ternata (6 feet).



3060. A bower or arbor of rustic work, with roses and clematis.—To show an English scene (Garden of S. Charrington, from "Gardening Illustrated").

Cistus in variety (2 to 4 feet).
Cotoneaster in variety (2 to 8 feet).
Cytisus in variety (6 to 8 feet).
*Diosma ericoides (4 feet).
†Dombeya natalensis (10 to 12 feet).
†Dombeya spectabilis (8 to 10 feet).
*Duranta Plumieri (6 to 8 feet).
Escallonia montevidensis (8 feet).
Escallonia pulverulenta (8 to 10 feet).
Escallonia rosea (8 feet).
Eugenia apiculata (8 feet).
†Eugenia jambolana (10 to 15 feet).
†Eugenia myrtifolia (10 to 15 feet).
†Eugenia uniflora (6 to 8 feet).
†Euphorbia pulcherrima (6 to 8 feet).
Feijoa Sellowiana (8 feet).
*Genista monosperma (6 to 8 feet).
*Grevillea Thelemanniana (4 feet).
*Hardenbergia monophylla (5 feet).
†Hibiscus heterophyllus (8 feet).
†Hibiscus Rosa-sinensis (8 to 10 feet).
†Iochroma in variety (8 to 10 feet).
Jasminum humile (6 feet).
*Lantana in variety (4 to 6 feet).
Leptospermum scoparium var. Chapmannii (8 feet).
Leptospermum scoparium var. Nichollii (4 to 6 feet).
Leptospermum scoparium var. bullatum (4 feet).
Leptospermum laevigatum (6 to 10 feet).
Loniceria nitida (4 to 6 feet).
*Malvaviscus mollis (6 feet).
Melaleuca in variety (6 to 10 feet).
Metrosideros lucida (6 feet).
Metrosideros robusta (8 feet).
Myrtus communis (3 to 5 feet).
Nerium Oleander (8 to 10 feet).
†Ozera pulchella (2 to 4 feet).
Photinia serrulata (10 to 12 feet).
Pimelea ferruginea (4 to 6 feet).
Pittosporum eugenioides (10 to 15 feet).
*Pittosporum rhombifolium (10 to 15 feet).
Pittosporum tenuifolium (10 to 15 feet).

- **Pittosporum undulatum* (10 to 15 feet).
- **Pittosporum viridiflorum* (8 to 10 feet).
- **Polygala Dalmaisiana* (3 to 5 feet).
- **Prunus lusitanica* (8 feet).
- **Psidium Cattleianum* (3 to 6 feet).
- **Pyracantha angustifolia* (6 feet).
- **Pyracantha coccinea* (6 to 8 feet).
- **Quillaja Saponaria* (10 to 15 feet).
- **Raphiolepis indica* (6 to 8 feet).
- **Raphiolepis umbellata* (4 to 6 feet).
- **Rhodorhiza florida* (6 feet).
- **Salvia Sessei* (6 feet).
- **Sparmannia africana* (8 feet).
- **Spartium junceum* (6 to 8 feet).
- **Sphaeralcea umbellata* (8 feet).
- **Solanum Rantonnetii* (6 feet).
- **Streptosolen Jamesonii* (3 to 6 feet).
- **Tecoma capensis* (8 feet).
- **Tecoma Smithii* (6 to 8 feet).
- **Tithonia diversifolia* (8 to 10 feet).
- **Veronica* in variety (2 to 6 feet).
- **Viburnum suspensum* (6 feet).
- **Wigandia caracasana* (8 to 10 feet).

Group IV. Shrubs resistant to soil and climatic conditions along the California seacoast.

The plants in this list are fairly resistant to the effects of strong prevailing winds and thrive in dry sandy soils containing more or less salt and are therefore valuable for windbreaks and shelter plantings. In general, the finer the foliage and the more willowy or wire-like the branches, the more easily do they withstand the trying conditions. A noticeable exception is some few kinds of hardy palms which thrive under such conditions because of the stiff character of their leaves and stems.

Evergreen.

- **Cupressus macrocarpa* (10 to 20 feet).
- **Tamarix* in variety (8 feet).
- **Myrica californica* (8 to 10 feet).
- **Acacia longifolia* (6 to 10 feet).
- **Atriplex Breweri* (6 feet).
- **Casuarina* in variety (10 to 25 feet).
- **Coprosma Baueri* (6 feet).
- **Rhus integrifolia* (6 feet).
- **Leptospermum* in variety (6 to 10 feet).
- **Melaleuca* in variety (6 to 10 feet).
- **Callistemon* in variety (4 to 8 feet).
- **Myoporum laetum* (8 to 12 feet).
- **Veronica* in variety (2 to 6 feet).
- **Anthyllis Barba-Jovis* (4 to 6 feet).
- **Juniperus* in variety (2 to 8 feet).
- **Ulex europaeus* (6 feet).
- **Rhamnus californica* (8 to 10 feet).
- **Ceanothus thyrsiflorus* (6 to 10 feet).
- **Acacia melanoxylon* (10 to 25 feet).
- **Acacia Farnesiana* (10 to 12 feet).
- **Acacia armata* (6 to 8 feet).
- **Coronilla glauca* (4 to 6 feet).
- **Pittosporum crassifolium* (10 to 15 feet).
- **Pittosporum phylliraeoides* (10 to 15 feet).
- **Pittosporum Tobira* (8 to 10 feet).
- **Escallonia rubra* (6 feet).
- **Dodonaea* in variety (8 feet).
- **Spartium junceum* (6 to 8 feet).
- **Lythamnus floribundus* var. *asplenifolius* (15 to 20 feet).
- **Medicago arborea* (6 feet).
- **Cytisus* in variety (6 to 8 feet).
- **Metrosideros tomentosa* (6 to 12 feet).
- **Phillyrea latifolia* (10 feet).
- **Polygala Dalmaisiana* (3 to 5 feet).
- **Maytenus Boaria* (10 to 20 feet).
- **Hakea* in variety (8 to 10 feet).
- **Lycium chinense* (6 feet).
- **Ceratonia Siliqua* (8 to 12 feet).
- **Elaeagnus pungens* (6 feet).
- **Artemisia arborescens* (6 feet).
- **Statice* in variety (1 foot).
- **Ficus macrophylla* (10 to 20 feet).
- **Echium* in variety (4 to 6 feet).

Palms.

- **Chamaerops humilis* (6 feet).
- **Phoenix canariensis* (15 feet).
- **Phoenix dactylifera* (20 feet).
- **Trachycarpus excelsus* (20 feet).
- **Sabal Palmetto* (12 feet).
- **Erythra armata* (15 feet).
- **Washingtonia filifera* (20 feet).
- **Erythra edulis* (15 feet).

Group V. Shrubs resistant to heat, drought, and neglect.

In some semi-arid sections of California, it is necessary to use plants that will grow more or less success-

fully under conditions of severe heat, drought, and neglect. Plants in this list are especially useful in those situations where no attention can be given after the plant is once established.

Evergreen.

- **Casuarina* in variety (10 to 25 feet).
- **Acacia* in variety (5 to 20 feet).
- **Atriplex Breweri* (6 feet).
- **Pittosporum phylliraeoides* (10 to 15 feet).
- **Olea europaea* (10 to 15 feet).
- **Pittosporum crassifolium* (10 to 15 feet).
- **Tristania conferta* (10 to 20 feet).
- **Photinia arbutifolia* (8 to 10 feet).
- **Spartium junceum* (6 to 8 feet).
- **Rhamnus californica* (8 to 10 feet).
- **Ceanothus* in variety (6 to 10 feet).
- **Cytisus* in variety (6 to 8 feet).
- **Hakea* in variety (8 to 10 feet).
- **Ligustrum* in variety (8 to 10 feet).
- **Callistemon* in variety (4 to 8 feet).
- **Melaleucas* in variety (6 to 10 feet).
- **Cistus* in variety (2 to 4 feet).
- **Albissia lophantha* (8 feet).
- **Parkinsonia aculeata* (8 to 10 feet).
- **Nerium Oleander* (8 to 10 feet).
- **Myoporum laetum* (8 to 12 feet).
- **Raphiolepis umbellata* (4 to 6 feet).
- **Carpenteria californica* (6 to 8 feet).
- **Ceratonia Siliqua* (8 to 12 feet).
- **Evonymus japonica* (6 to 8 feet).
- **Arbutus Unedo* (8 feet).
- **Cassia tomentosa* (8 feet).
- **Cassia artemisioides* (4 feet).
- **Leptospermum* in variety (6 to 10 feet).
- **Agonia flexuosa* (8 to 10 feet).
- **Calothamnus quadrifidus* (5 feet).
- **Elaeagnus pungens* (6 feet).
- **Romneya Coulteri* (6 feet).
- **Buddleia* in variety (6 to 8 feet).
- **Coronilla glauca* (4 to 6 feet).
- **Dodonaea cuneata* (6 to 8 feet).
- **Dodonaea viscosa* (8 feet).
- **Echium* in variety (4 to 6 feet).
- **Phillyrea latifolia* (10 feet).
- **Metrosideros tomentosa* (6 to 12 feet).
- **Malvaviscus mollis* (6 feet).
- **Prunus ilicifolia* var. *integrifolia* (10 to 12 feet).
- **Prunus caroliniana* (10 to 12 feet).
- **Pyracantha crenulata* (6 to 8 feet).

Deciduous.

- **Tamarix parviflora* (6 to 8 feet).
- **Tamarix hispida* var. *aestivalis* (6 to 8 feet).
- **Chenomeles japonica* (6 feet).
- **Funica Granatum* (6 feet).
- **Berberis vulgaris* var. *atropurpurea* (6 to 8 feet).
- **Evonymus europaea* (8 feet).
- **Prunus cerasifera* var. *atropurpurea* (10 to 12 feet).

Group VI. Shrubs which are especially free-flowering.

Many species of ornamental shrubs are particularly free-flowering in California, while others possess several flowering periods throughout the year. Because of their tendency to bloom in the fall and winter seasons, they are especially useful in the more intensively developed gardens where all-the-year-round effects are desired.

Evergreen.

- **Choisya ternata* (6 feet).
- **Cestrum elegans* (6 feet).
- **Veronica* in variety (2 to 6 feet).
- **Polygala Dalmaisiana* (3 to 5 feet).
- **Grevillea Thelemanniana* (4 feet).
- **Rhodorhiza florida* (6 feet).
- **Lantana* in variety (4 to 6 feet).
- **Fuchsia* in variety (6 feet).
- **Sollya heterophylla* (3 feet).
- **Berberis Darwinii* (6 to 8 feet).
- **Escallonia rubra* (4 to 6 feet).
- **Streptosolen Jamesonii* (3 to 6 feet).
- **Spartium junceum* (6 to 8 feet).
- **Abelia grandiflora* (6 feet).
- **Heterocentron roseum* (1 foot).
- **Genista monosperma* (6 to 8 feet).
- **Pimelea ferruginea* (4 to 6 feet).
- **Bouvardia Humboldtii* (5 feet).
- **Cistus ladaniferus* var. *maculatus* (2 to 4 feet).
- **Statice* in variety (1 foot).
- **Anthyllis Barba-Jovis* (4 to 6 feet).
- **Reinwardtia trigyna* (3 feet).
- **Lochroma* in variety (8 to 10 feet).
- **Escallonia pulverulenta* (8 to 10 feet).
- **Jacobinia pauciflora* (2 feet).

- †*Dodalacanthus nervosus* (2 feet).
- Cytisus racemosus* (2 to 3 feet).
- **Duranta Plumieri* (6 to 8 feet).
- Coronilla glauca* (4 to 6 feet).
- Cassia artemisioides* (4 feet).
- **Malva viscosa* (6 feet).
- †*Cuphea* in variety (2 feet).
- **Philadelphus mexicanus* (5 feet).
- **Tibouchina splendens* (5 feet).
- Escallonia rosea* (8 feet).
- **Cestrum aurantiacum* (6 to 8 feet).
- Erica mediterranea* (3 feet).
- Erica melanthera* (3 feet).
- **Plumbago capensis* (4 feet).
- **Trachelospermum jasminoides* (3 feet).
- Cassia tomentosa* (8 feet).
- **Eugenia myrtifolia* (10 to 15 feet).
- †*Hibiscus* in variety (8 to 10 feet).
- **Tecoma capensis* (8 feet).
- **Swainsona galegifolia* var. *albiflora* (6 feet).
- **Calothamnus quadrifidus* (5 feet).

Group VII. Shrubs bearing ornamental fruits and berries.

The berried and fruit-bearing ornamental trees and shrubs form one of the most interesting classes of decorative plants. Not only do they produce a flower display throughout the spring and summer months but also add flashes of color for long periods in the fall and winter by their clusters of bright berries or fruits. Only those kinds bearing persistent fruit and of a color contrasting well with green foliage are acceptable in California. Such deciduous berried shrubs as have proved themselves adaptable are included in the list.

Those producing berried effects.

- Pyracantha coccinea* (6 to 8 feet).
- Pyracantha crenulata* (6 feet).
- Pyracantha angustifolia* (6 feet).
- Cotoneaster Franchetii* (4 to 6 feet).
- Cotoneaster Dielsiana* (4 to 6 feet).
- Cotoneaster horizontalis* (2 to 3 feet).
- Cotoneaster pannosa* (6 to 8 feet).
- Cotoneaster acuminata* (6 to 8 feet).
- Cotoneaster buxifolia* (2 to 3 feet).
- Cotoneaster microphylla* (2 to 3 feet).
- Cotoneaster frigida* (8 to 10 feet).
- Photinia arbutifolia* (8 to 10 feet).
- **Myrtus Ugni* (4 feet).
- **Duranta Plumieri* (6 to 8 feet).
- Berberis Darwinii* (6 to 8 feet).
- Ilex Aquifolium* (6 to 10 feet).
- **Cestrum elegans* (6 feet).
- **Cestrum aurantiacum* (6 to 8 feet).
- **Pittosporum rhombifolium* (10 to 15 feet).
- **Pittosporum viridiflorum* (10 feet).
- Arbutus Menziesii* (10 to 20 feet).
- Lycium chinense* (6 feet).
- Rhamnus californica* (8 to 10 feet).
- Rhamnus crocea* (4 feet).
- Nandina domestica* (6 feet).

Deciduous.

- Elaeagnus umbellata* (10 feet).
- Symphoricarpos albus* (3 feet).
- Crataegus cordata* (10 feet).
- Berberis Thunbergii* (3 feet).
- Sorbus Aucuparia* (10 to 15 feet).
- Symphoricarpos vulgaris* (3 feet).
- Sambucus racemosa* (10 feet).

Those producing fruit effects.

- Arbutus Unedo* (8 feet).
- **Eugenia myrtifolia* (10 to 15 feet).
- †*Eugenia uniflora* (6 to 8 feet).
- Cornus capitata* (10 feet).
- **Paidium* in variety (4 to 8 feet).
- Aucuba japonica* (4 feet).
- Eriobotrya japonica* (10 to 12 feet).
- Feijoa Sellowiana* (8 feet).

Deciduous.

- Evonymus europaea* (6 to 8 feet).
- Evonymus alata* (6 to 8 feet).
- Ribes speciosum* (4 feet).
- Punica Granatum* (6 feet).
- Diospyros* in variety (6 to 8 feet).
- Rosa rugosa* (3 feet).
- Chaenomeles japonica* (6 feet).
- Pyrus floribunda* (10 to 12 feet).

Group VIII. Shrubs for hedges (California).

Many shrubs of a compact habit may be used as hedge-plants. There is, however, a fairly well-es-

lished group of desirable species that lend themselves more easily to training of this kind. Those listed below are used extensively for hedges and have been found to adapt themselves readily to the severe system of trimming and to produce the dense and compact form desired.

Low edgings or boxings (6 to 18 inches).

- Berberis Darwinii*.
- Buxus sempervirens* var. *suffruticosa*.
- **Eugenia myrtifolia*.
- Lonicera nitida*.
- Veronica buxifolia*.
- Myrtus communis* var. *microphylla*.
- Myrtus Ugni*.
- Evonymus japonica* var. *microphylla*.
- Veronica Traversii*.
- Veronica carnea*.
- Cotoneaster microphylla*.
- Erica mediterranea*.
- **Diosma ericoides*.
- **Jacobinia pauciflora*.
- Cistus ladaniferus* var. *maculatus*.

Small hedges (2 to 6 feet).

- Berberis Darwinii*.
- **Eugenia myrtifolia*.
- Eugenia apiculata*.
- Buxus sempervirens*.
- Taxus baccata*.
- Lonicera nitida*.
- Osmanthus Aquifolium* var. *myrtifolius*.
- Prunus ilicifolia*.
- Pittosporum tenuifolium*.
- Pittosporum eugenioides*.
- Myrtus communis*.
- Escallonia rubra*.
- **Atriplex Breweri*.
- **Grevillea Thelemanniana*.
- Ligustrum sinense*.
- Ligustrum ovalifolium*.
- Choisya ternata*.
- Pyracantha crenulata*.
- **Aberia caffra*.
- Erica* in variety.
- Elaeagnus pungens*.
- Pyracantha angustifolia*.
- Veronica decussata*.
- Veronica imperialis*.
- Veronica elliptica*.
- Pimelea ferruginea*.
- Viburnum Tinus* var. *strictum*.
- Leptospermum laevigatum*.
- Evonymus japonica*.
- Acacia longifolia*.
- Acacia armata*.
- Ceanothus spinosus*.
- **Paidium Cattleianum*.
- **Lantana*, dwarf hybrids.

High hedges (6 to 12 feet).

- Pittosporum tenuifolium*.
- Pittosporum eugenioides*.
- **Pittosporum undulatum*.
- Pittosporum crassifolium*.
- Prunus ilicifolia* var. *integrifolia*.
- Ligustrum ovalifolium*.
- Ligustrum japonicum*.
- Prunus caroliniana*.
- Escallonia pulverulenta*.
- Cupressus macrocarpa*.
- Hakea suaveolens*.
- Hakea saligna*.
- Acacia longifolia*.
- Acacia melanoxylon*.
- Acacia retinodes*.
- Acacia verticillata*.
- Pyracantha coccinea*.
- Spartium junceum*.

Group IX. Shrubs for ground-covers (California).

There are often banks and slopes where a lawn would be too expensive to maintain and unless covered with green foliage would remain unsightly. Other situations, especially under and between trees and large shrubs, would be materially improved if the ground-surface were covered with woody vines and trailing shrubs. It will be necessary to prune out the leader or upright stem of many of these shrubs to encourage their spreading or horizontal growth.

- Juniperus chinensis* var. *procumbens* (3 feet).
- Juniperus Sabina* var. *tamariscifolia* (3 feet).
- Jasminum primulinum* (6 feet).

Sollya heterophylla (3 feet).
Hypericum calycinum (1 foot).
Hypericum Moerhousii (3 feet).
 **Philadelphus mexicanus* (5 feet).
 **Trachelospermum jasminoides* (3 feet).
 †*Cuphea micropetala* (3 feet).
 **Cuphea ignea* (5 feet).
 †*Chianthus puniceus* (3 to 6 feet).
 **Streptosolen Jamesonii* (3 to 6 feet).
 **Plumbago capensis* (4 feet).
 †*Myrtus communis* (3 to 5 feet).
 †*Cotoneaster microphylla* (2 to 3 feet).
 †*Cotoneaster horizontalis* (2 to 3 feet).
 **Coprosma Baueri* (6 feet).
 †*Evonymus radicans* (2 feet).
 †*Fuchsia Riccartonii* (6 feet).
 †*Leptospermum laevigatum* (6 to 10 feet).
 **Tecoma capensis* (3 feet).
 **Reinwardtia trigyna* (4 feet).
 **Capparis spinosa* (3 feet).
 **Swainsona galegifolia* var. *albiflora* (6 feet).
 †*Teucrium fruticosum* (6 feet).
 †*Coronilla glauca* (4 to 6 feet).
 †*Melaleuca decussata* (5 feet).
 †*Cistus ladaniferus* var. *maculatus* (2 to 4 feet).
 †*Evonymus japonica* var. *viridi-variegata* (4 feet).
 †*Lantana Sellowiana* (4 feet).
 **Lantana Camara* (4 to 6 feet).
 †*Chorizanthe major* (4 feet).
 **Buddleia madagascariensis* (6 to 10 feet).
 †*Jasminum humile* (6 feet).
 **Solanum Rantonnetii* (6 feet).
 †*Artemisia arborescens* (5 feet).
 †*Pentstemon cordifolius* (3 feet).
 **Heliotropium* in variety (3 feet).
 †*Pittosporum heterophyllum* (3 feet).
 **Fuchsia fulgens* (5 feet).
 **Fuchsia corymbiflora* (6 feet).

Group X. Shrubs for quick effects (California).

Many shrubs are of rapid growth and if given heat and moisture will produce very quick effects. They are, therefore, especially suitable for screens, barriers, and mature effects in recently created gardens.

†*Myoporum laetum* (8 to 12 feet).
 †*Albissia lophantha* (10 feet).
 †*Leptospermum laevigatum* (6 to 10 feet).
 †*Acacia* in variety (6 to 20 feet).
 †*Melaleuca* in variety (6 to 10 feet).
 †*Spartium junceum* (6 to 8 feet).
 †*Casuarina* in variety (10 to 25 feet).
 †*Tithonia diversifolia* (8 to 10 feet).
 **Wigandia caracasana* (3 to 10 feet).
 **Lantana* in variety (4 to 6 feet).
 †*Cytisus* in variety (6 to 8 feet).
 **Lochroma* in variety (8 to 10 feet).
 **Cassia* in variety (4 to 10 feet).
 **Buddleia* in variety (6 to 8 feet).
 **Cestrum* in variety (6 to 8 feet).
 **Plumbago capensis* (4 feet).
 †*Solanum Warszewiczii* (8 feet).
 †*Dodonaea cuneata* (6 to 8 feet).
 †*Bocconia frutescens* (8 feet).
 †*Pittosporum undulatum* (10 to 15 feet).
 †*Pittosporum eugenioides* (10 to 15 feet).
 †*Pittosporum crassifolium* (10 to 15 feet).
 **Coprosma Baueri* (6 feet).
 †*Veronica* in variety (2 to 6 feet).
 **Sparmannia africana* (8 feet).
 †*Coronilla glauca* (4 to 6 feet).
 **Anthyllis Barba-Jovis* (4 to 6 feet).
 **Agonis flexuosa* (8 to 10 feet).
 †*Fatsia japonica* (6 feet).
 †*Ligustrum ovalifolium* (6 to 8 feet).
 †*Escallonia* in variety (6 to 10 feet).
 †*Pimelea ferruginea* (4 to 6 feet).
 †*Cuphea micropetala* (2 feet).
 **Streptosolen Jamesonii* (3 to 6 feet).
 **Grevillea Thelemanniana* (4 feet).
 **Atriplex Breweri* (6 feet).
 **Melanthus major* (4 feet).
 †*Parkinsonia aculeata* (8 to 10 feet).
 †*Ceanothus arborea* (8 feet).
 †*Muehlenbeckia platyclada* (6 feet).
 †*Clerodendron* in variety (6 feet).
 †*Abutilon* in variety (8 feet).
 †*Carica quercifolia* (6 to 8 feet).

Agonis flexuosa, Schau. A tall shrub or tree from Austral. lvs. lanceolate, smooth, dark green, the margins tinged with purple; fl.-heads white, axillary, surrounded by broad bracts; stamens long, numerous, white.

Group XI. Especially choice and neat shrubs.

Those shrubs which are free-flowering, compact, and possess interesting and well-arranged foliage, are

much in demand for the more intensively developed parts of a garden. They are particularly suitable for use on small home grounds, in formal gardens, and around the base-line of buildings.

Erica in variety (4 feet).
 †*Diosma ericoides* (3 feet).
 **Eugenia myrtifolia* (10 to 15 feet).
 †*Choisya ternata* (6 feet).
 †*Daphne odora* (3 feet).
 **Grevillea Thelemanniana* (4 feet).
 †*Leptospermum scoparium* var. *Nicholii* (4 to 6 feet).
 †*Lonicera nitida* (4 to 6 feet).
 †*Berberis Darwinii* (6 to 8 feet).
 †*Abelia grandiflora* (6 feet).
 †*Pimelea ferruginea* (4 to 6 feet).
 **Myrtus Ugni* (4 feet).
 †*Templetonia retusa* (3 feet).
 †*Asystasia bella* (3 feet).
 †*Sollya heterophylla* (3 feet).
 **Trachelospermum jasminoides* (3 feet).
 **Philadelphus mexicanus* (5 feet).
 †*Michelia fuscata* (6 feet).
 †*Heterocentron roseum* (1 foot).
 †*Dedalicanthus nervosus* (2 feet).
 †*Cassia artemisioides* (4 feet).
 †*Eugenia apiculata* (8 feet).
 †*Myrtus communis* var. *microphylla* (2 to 3 feet).
 **Coprosma Baueri* (6 feet).
 **Cneorum tricocon* (3 feet).
 †*Cotoneaster horizontalis* (2 to 3 feet).
 †*Cotoneaster Franchetii* (4 to 6 feet).
 †*Cotoneaster microphylla* (2 to 3 feet).
 †*Ligustrum obovatum* (3 to 6 feet).
 †*Ligustrum sinense* (6 feet).
 **Genista monosperma* (6 to 8 feet).
 †*Rhododendron florida* (6 feet).
 †*Aucuba japonica* (4 feet).
 †*Asara microphylla* (8 feet).
 †*Buxus* in variety (2 to 8 feet).
 †*Camellia japonica* (8 feet).
 †*Cytisus racemosus* (2 to 3 feet).
 †*Evonymus japonica* var. *aureo-marginata* (6 to 8 feet).
 †*Evonymus japonica* var. *viridi-variegata* (4 feet).
 †*Mahonia japonica* (4 feet).
 †*Melaleuca decussata* (5 feet).
 †*Nandina domestica* (6 feet).
 †*Osmanthus Aquifolium* (4 feet).
 †*Veronica* in variety (2 to 6 feet).
 **Carissa grandiflora* (4 feet).
 †*Hardenbergia monophylla* (5 feet).
 †*Jasminum primulinum* (6 feet).
 †*Metrosideros lucida* (6 feet).
 **Tibouchina splendens* (5 feet).
 †*Salvia Sessei* (6 feet).
 **Fuchsia corymbiflora* (6 feet).
 **Fuchsia fulgens* (4 feet).
 **Fuchsia arborescens* (6 feet).
 **Duranta Plumieri* var. *alba* (3 to 6 feet).

Cneorum tricocon, Linn., the spurge olive, is a native of S. Eu.: smooth, evergreen, 1 or 2 ft. high; lvs. narrow, entire, obtuse; fls. axillary; pedicels not adnate to the bracts. *Cneorum* is one of the Simarubaceae, or by recent authorities made the sole representative of the family Cneoraceae.

Group XII. Ornamental native shrubs.

While the native shrubs of California are not, in many cases, so effective and attractive for landscape purposes as most of the exotic material used, there is a growing interest in their ornamental qualities. They may be employed extensively to give character to the extremely naturalistic home grounds and to the typically Californian garden. Only the more ornamental species in general cultivation are listed below.

†*Carpenteria californica* (6 to 8 feet).
 †*Ceanothus thyrsiflorus* (8 feet).
 †*Photinia arbutifolia* (8 to 10 feet).
 †*Lyonothamnus floribundus* var. *asplenifolius* (15 to 20 feet).
 †*Prunus ilicifolia* var. *integrifolia* (10 to 15 feet).
 †*Arbutus Menziesii* (10 to 20 feet).
 †*Ceanothus arboreus* (8 to 10 feet).
 †*Ceanothus spinosus* (6 to 8 feet).
 †*Parkinsonia aculeata* (8 to 10 feet).
 †*Garrya Fremontii* (6 feet).
 †*Romneya Coulteri* (6 feet).
 †*Ribes speciosum* (4 feet).
 †*Vaccinium ovatum* (3 feet).
 †*Mahonia Aquifolium* (4 feet).
 †*Rhamnus californica* (8 to 10 feet).
 †*Rhus integrifolia* (6 feet).
 †*Rhus ovata* (6 to 8 feet).
 †*Rhamnus crocea* var. *ilicifolia* (4 feet).
 †*Umbellularia californica* (15 to 30 feet).
 †*Cercocarpus parvifolius* (8 feet).
 **Gaultheria Shallon* (2 feet).

Arctostaphylos in variety (6 feet).
 Fremontia californica (8 feet).
 Calycanthus occidentalis (6 feet).
 Dendromecon rigidum (6 feet).
 *Lavatera assurgentiflora (6 feet).
 *Mimulus glutinosus (4 feet).

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Vines for California.

In countries where there is a maximum of sunlight, vines become a most important class of plant-material. The many vines used in California are roughly divided into classes according to the climatic divisions of the state. Tropical and semi-tropical evergreen vines find most favor in southern California, where gorgeous coloring and luxurious growth appear most in harmony with the landscape; while the half-hardy evergreens and the choicest deciduous vines are most suitable for use along the central California coast. On the other hand, the vine which loses its foliage in winter finds the greatest favor in the interior sections of the state, although such few evergreens as withstand several degrees of frost are often employed for decorative purposes. When very quick effects are wanted, the annual vine is often used.

All vines except those clinging to rough surfaces need substantial support, while most vines require a certain amount of thinning and training. The tendency is to neglect the plant after it is once established and allow it to form thick unsightly masses of stems near the top of the support, thereby destroying such decorative beauty as the vine may possess. Vines should not be "headed back" or heavily pruned unless the plant is to be renovated, as a coarse rank growth is encouraged. If possible, choose strong stems as leaders and train in a fan-like manner so as finally to cover the desired area. Spring-flowering vines should be pruned soon after blooming, while summer- and fall-flowering vines may be thinned in the spring. The foliage of evergreen vines may be best reduced by careful selective thinning immediately after a blooming period. Always begin to train a vine as soon as possible; do not wait for it to begin to climb.

No climbing roses have been included in the following lists, as it is felt that they should be considered as a separate class of plant-material. Such vines as are not marked with "D" or "A" are evergreen, while those without an "o" or "x" are hardy. D=deciduous; A=annual; o=not resistant to frost; x=resistant to 10° to 12° of frost.

1. Vines which cover objects and surfaces densely.

The vines in this list have a tendency to cover their supports entirely, making a dense screen and thereby destroying architectural lines.

D—Actinidia chinensis.	x—Pandorea australis.
D—Akebia quinata.	o—Pandorea Brycei.
x—Buddleia madagascariensis.	x—Pandorea jasminoides.
D—Campeis chinensis.	x—Pandorea jasminoides var.
D—Campeis radicans.	alba.
Cardiospermum hirsutum.	D—Parthenocissus quinque-
D—Clematis montana.	folia.
D—Clematis paniculata.	D—Parthenocissus tricuspi-
x—Dolichos lignosus.	data.
Ficus pumila.	Passiflora cærulea.
Gelsemium sempervirens.	Passiflora cærulea var. alba.
Hedera helix.	o—Passiflora edulis.
Hedera helix var. chrysocarpa.	x—Passiflora manicata.
A—Humulus japonicus.	Passiflora mollissima.
D—Ipomoea Learii.	x—Pelargonium peltatum.
x—Jasminum gracillimum.	D—Periploca græca.
x—Jasminum grandiflorum.	x—Pithecoctenium muricatum.
x—Jasminum officinale.	x—Plumbago capensis.
Kennedy rubicunda.	x—Plumbago capensis var.
Lantana Sellowiana.	alba.
Lonicera japonica var. Halliana.	D—Pueraria hirsuta.
Lonicera Periclymenum var. belgica.	x—Salpichroa rhomboidea.
Melothria punctata.	D—Senecio mikanioides.
Muehlenbeckia complexa.	o—Solandra guttata.
	x—Serjania fuscifolia.
	x—Steptosolen Jamesonii.
	x—Tecoma capensis.

A—Tropæolum majus.
 x—Vitis (Cissus) antarctica.
 x—Vitis (Cissus) capensis.

D—Wisteria chinensis.
 D—Wisteria multi-juga.

2. Vines producing light open tracery.

Vines to be ornamental should decorate and not entirely cover. Their chief purpose is to soften and partially break hard architectural lines. It is the contrast between foliage and background which produces decorative effect. Vines of this section are especially good for columns, walls, and frames.

o—Abrus precatorius.	x—Hoya carnosa.
D—Antigonon leptopus.	x—Jasminum asoricum.
o—Aristolochia triangularis.	x—Jasminum nitidum.
x—Asparagus asparagoides.	D—Jasminum nudiflorum.
x—Asparagus plumosus.	x—Linaria Cymbalaria.
x—Asparagus plumosus var.	D—Mandevilla suaveolens.
comorensis.	Maurandia Barclaiana.
Bignonia Unguis-cati (B.	x—Maurandia Lophospermum.
Tweediana).	a—Momordica Balaamina.
D—Clematis Henryi.	x—Pithecoctenium cynan-
D—Clematis Jackmanii.	choidea.
D—Clematis montana var.	x—Pithecoctenium muricatum.
rubens.	x—Pyrostegia venusta.
x—Cobæa scandens.	Solanum jasminoides.
x—Dioclea glycinoides.	x—Solanum Seaforthianum.
o—Dipladenia hybrida.	Sollya heterophylla.
a—Eccremocarpus scaber.	o—Stigmaphyllon ciliatum.
x—Hardenbergia Comptoni-	o—Stigmaphyllon littorale.
ana.	o—Thunbergia grandiflora.
Hedera helix.	x—Trachelospermum jasmin-
o—Hidalgia Wercklei.	oides.

3. Vines as ground-covers on slopes, embankments, and under trees.

Vines require little care, hold the soil and make a permanent effect in those situations where the soil is too poor or too shady to maintain a satisfactory lawn.

Bignonia Unguis-cati.	Mesembryanthemum
x—Duchesnea indica.	cordifolium.
Fragaria californica.	Mesembryanthemum
Fragaria chiloensis.	roseum.
Hedera helix.	Muehlenbeckia chilensis.
a—Humulus japonicus.	Muehlenbeckia complexa.
x—Jasminum primulinum.	x—Pelargonium peltatum.
x—Lantana Camara.	D—Senecio mikanioides.
Lantana Sellowiana.	Sollya heterophylla.
Lippia canescens.	A—Tropæolum majus.
Lonicera japonica var. Hal-	Vinca major.
liana.	Vinca minor.
x—Lotus Bertholetii.	x—Vitis (Cissus) capensis.

4. Vines for stone, plaster, and brick surfaces.

Because of their various ways of clinging to rough surfaces, these vines need no support. They should not be grown on wood surfaces which are to be painted.

D—Bignonia capreolata.	Hedera helix.
Bignonia Unguis-cati (B.	Hedera helix var. chry-
Tweediana).	socarpa.
x—Cissus striata.	D—Parthenocissus quinque-
x—Clytostoma purpureum.	folia.
D—Decumaria barbara.	D—Parthenocissus quinque-
Evonymus radicans.	folia var. Engelmannii.
Evonymus radicans var.	D—Parthenocissus tricuspi-
roseo-marginata.	data.
Ficus pumila.	x—Phadranthus buccina-
Ficus pumila var. minima.	torius.

5. Vines for quick effects.

Useful to obtain mature effects in gardens. Rapid-growing deciduous vines are especially desirable for porches, pergolas, and arbors located in the large interior valleys.

D—Actinidia chinensis.	D—Ipomoea setosa.
D—Aristolochia macrophylla	x—Jasminum primulinum.
(A. Sipho).	x—Lantana Camara.
Bignonia Unguis-cati (B.	Lathyrus splendens.
Tweediana).	Lonicera japonica var.
D—Boussingaultia baaselloides.	Halliana.
x—Buddleia madagascariensis.	Maurandia Barclaiana.
D—Campeis radicans.	Melothria punctata.
D—Clematis montana.	x—Pandorea australis.
D—Clematis paniculata.	o—Pandorea Brycei.
Cobæa scandens.	Passiflora cærulea.
x—Dolichos lignosus.	Passiflora cærulea var.
x—Dolichos lignosus var. alba.	alba.
A—Humulus japonicus.	o—Passiflora edulis.
D—Humulus lupulus.	x—Passiflora manicata.
D—Ipomoea Learii.	x—Passiflora mollissima.

- o—*Passiflora racemosa* (P. princeps).
- x—*Passiflora tubiflora*.
- x—*Pelargonium peltatum*.
- x—*Phædranthus buccinatorius*.
- D—*Phaseolus Caracalla*.
- x—*Philadelphus mexicanus*.
- D—*Pueraria hirsuta*.
- x—*Salpichroa rhomboidea*.

- D—*Secchium edule*.
- D—*Senecio mikanoides*.
- Solanum jasminoides.
- D—*Solanum Wendlandii*.
- o—*Solandra guttata*.
- x—*Tecoma capensis*.
- D—*Thunbergia alata*.
- o—*Thunbergia coccinea*.
- A—*Tropæolum majus*.

6. Free-flowering vines for California.

Many vines produce only foliage effects or bloom but once a year. The vines in this list bear flowers more or less continuously. They are especially suitable for arbors and trellises in the flower-garden.

- o—*Allamanda cathartica* var. Hendersonii.
- D—*Antigonon leptopus*.
- o—*Beaumontia grandiflora*.
- x—*Bougainvillea brasiliensis*.
- x—*Bougainvillea glabra*.
- x—*Bougainvillea spectabilis* var. lateritia.
- Cardiospermum hirsutum*.
- x—*Chorizema ilicifolium*.
- A—*Clitoria Ternata*.
- x—*Clytostoma callistegioides*.
- Cobaea scandens*.
- x—*Dolichos lignosus*.
- x—*Dolichos lignosus* var. alba.
- x—*Hardenbergia Comptoniana*.
- x—*Jasminum asoricum*.
- x—*Jasminum floribundum*.
- x—*Jasminum gracillimum*.
- x—*Jasminum grandiflorum*.
- x—*Jasminum*, Maid of Orleans.
- o—*Jasminum nitidum*.
- x—*Jasminum simplicifolium*.
- Jasminum Sambac*, Grand Duke.
- x—*Lantana Camara*.
- Lantana Sellowiana*.
- Lathyrus latifolius* var. albus.
- Lathyrus splendens*.
- Lonicera japonica* var. Haliana.
- Lonicera sempervirens*.
- D—*Mandevilla suaveolens*.
- Manettia bicolor.
- x—*Pandorea jasminoides*.
- x—*Pandorea jasminoides* var. alba.
- x—*Passiflora militaris*.
- o—*Passiflora racemosa* (P. princeps).
- x—*Pelargonium peltatum*.
- x—*Phædranthus buccinatorius*.
- D—*Phaseolus Caracalla*.
- x—*Pithecoctenium muricatum*.
- x—*Plumbago capensis*.
- x—*Pyrostegia venusta*.
- o—*Schubertia grandiflora*.
- o—*Solandra grandiflora*.
- Solanum jasminoides.
- x—*Solanum Seaforthianum*.
- D—*Solanum Wendlandii*.
- x—*Sollya heterophylla*.
- o—*Stephanotis floribunda*.
- o—*Stigmaphyllon ciliatum*.
- x—*Swainsona galegifolia* var. albiflora.
- x—*Tecoma capensis*.
- o—*Thunbergia grandiflora*.
- x—*Trachelospermum jasminoides*.
- D—*Tropæolum majus*.

7. Vines somewhat resistant to shade.

Good for courts, north sides of buildings, under trees and on shady slopes.

- x—*Asparagus asparagoides*.
- x—*Asparagus plumosus*.
- x—*Chorizema ilicifolium*.
- x—*Clianthus puniceus*.
- x—*Clytostoma callistegioides*.
- Ficus pumila*.
- Ficus pumila* var. minima.
- Hedera colchica* (H. Rægnieriana).
- Hedera helix*.
- x—*Hoya carnosa*.
- x—*Jasminum asoricum*.
- x—*Jasminum gracillimum*.
- x—*Jasminum primulinum*.
- x—*Linaria Cymbalaria*.
- Lippia canescens*.
- D—*Micromeria Chamissonis*.
- x—*Pandorea australis*.
- D—*Parthenocissus quinquefolia*.
- D—*Parthenocissus tricuspidata*.
- o—*Quisqualis indica*.
- D—*Senecio mikanoides*.
- x—*Solanum Seaforthianum*.
- Sollya heterophylla*.
- o—*Stephanotis floribunda*.
- o—*Thunbergia laurifolia*.
- x—*Trachelospermum jasminoides*.
- Tradescantia virginiana*.
- Vinca major*.
- Vinca minor*.
- x—*Vitis (Cissus) antarctica*.
- x—*Vitis (Cissus) capensis*.
- x—*Vitis (Cissus) rhombifolia*.

8. Vines somewhat resistant to drought.

Vines are largely natives of cool moist forest floors where the soil is deep and loose, but the following will endure a certain amount of drought and hard clay soils.

- Bignonia Unguis-cati* (B. Tweediana).
- x—*Bougainvillea*.
- x—*Buddleia madagascariensis*.
- x—*Dioclea glycinoides*.
- x—*Dolichos lignosus*.
- Evonymus radicans*.
- Ficus pumila*.
- Hedera helix*.
- x—*Jasminum primulinum*.
- x—*Lantana Camara*.
- x—*Lantana Sellowiana*.
- Lathyrus latifolius*.
- Lathyrus splendens*.
- Lippia canescens*.
- Lonicera japonica* var. Haliana.
- Lonicera Periclymenum* var. belgica.
- Mesembryanthemum roseum*.
- Muehlenbeckia complexa*.
- x—*Pandorea australis*.
- Pandorea jasminoides*.
- x—*Passiflora manicata*.
- x—*Passiflora mollissima*.
- x—*Pelargonium peltatum*.
- D—*Periploca græca*.
- x—*Plumbago capensis*.
- x—*Salpichroa rhomboidea*.
- D—*Senecio mikanoides*.
- x—*Serjania fuscifolia*.
- Solanum jasminoides.
- Sollya heterophylla*.

- x—*Streptosolen Jamesonii*.
- x—*Tecoma capensis*.
- D—*Tropæolum majus*.
- Vinca major*.
- Vinca major*, variegated.
- Vinca minor*.

9. Vines for pergolas and arbors.

For this purpose vines should not be allowed to make too heavy top growth and they should be so trained that a certain amount of their foliage is pendent.

- D—*Antigonon leptopus*.
- D—*Aristolochia macrophylla* (A. Siphon).
- o—*Aristolochia elegans*.
- Bignonia Unguis-cati* (B. Tweediana).
- x—*Bougainvillea brasiliensis*.
- o—*Beaumontia grandiflora*.
- D—*Clematis montana*.
- D—*Clematis paniculata*.
- x—*Clytostoma purpureum*.
- x—*Dioclea glycinoides*.
- Gelsemium sempervirens*.
- x—*Hardenbergia Comptoniana*.
- Hedera colchica* (H. Rægnieriana).
- Hedera helix*.
- Hedera helix* var. chrysocarpa.
- o—*Hidalgia Wercklei*.
- A—*Humulus japonicus*.
- x—*Jasminum asoricum*.
- x—*Jasminum floribundum*.
- x—*Jasminum grandiflorum*.
- x—*Jasminum nitidum*.
- x—*Jasminum officinale*.
- x—*Jasminum primulinum*.
- x—*Jasminum rigidum* (J. ligustrifolium).
- x—*Lonicera Hildebrandiana*.
- Lonicera japonica* var. Haliana.
- D—*Mandevilla suaveolens*.
- Muehlenbeckia complexa*.
- x—*Pandorea jasminoides*.
- x—*Pandorea jasminoides* var. alba.
- o—*Pandorea Brycei*.
- D—*Periploca græca* (Silk Vine).
- x—*Phædranthus buccinatorius*.
- x—*Philadelphus mexicanus*.
- x—*Pithecoctenium cynanchoides*.
- x—*Pithecoctenium muricatum*.
- o—*Solandra guttata*.
- Solanum jasminoides.
- x—*Solanum Seaforthianum*.
- D—*Solanum Wendlandii*.
- x—*Stauntonia hexaphylla*.
- o—*Stephanotis floribunda*.
- o—*Stigmaphyllon ciliatum*.
- x—*Tecoma capensis*.
- o—*Thunbergia grandiflora*.
- x—*Vitis (Cissus) capensis*.
- x—*Vitis Romanetti*.
- D—*Wisteria chinensis*.
- D—*Wisteria multijuga*.
- D—*Wisteria multijuga* var. alba.

10. Foliage vines for California.

Many vines are especially ornamental because of their foliage effects. Those with smooth bright green closely arranged leaves are most desirable.

- D—*Actinidia chinensis*.
- D—*Ampelopsis arborea*.
- D—*Aristolochia macrophylla* (A. Siphon).
- x—*Asparagus asparagoides*.
- x—*Cissus striata*.
- x—*Clytostoma callistegioides*.
- Cobaea scandens*.
- x—*Dolichos lignosus*.
- Evonymus radicans*.
- Ficus pumila*.
- Gelsemium sempervirens*.
- A—*Humulus japonicus*.
- x—*Jasminum asoricum*.
- x—*Jasminum gracillimum*.
- x—*Jasminum rigidum* (J. ligustrifolium).
- x—*Pandorea australis*.
- x—*Pandorea jasminoides*.
- o—*Passiflora edulis*.
- o—*Passiflora laurifolia*.
- o—*Passiflora ligularia*.
- x—*Phædranthus buccinatorius*.
- D—*Pueraria hirsuta*.
- D—*Senecio mikanoides*.
- x—*Serjania fuscifolia*.
- x—*Solanum Seaforthianum*.
- D—*Solanum Wendlandii*.
- x—*Stauntonia hexaphylla*.
- o—*Thunbergia grandiflora*.
- x—*Vitis (Cissus) antarctica*.
- x—*Vitis (Cissus) capensis*.
- x—*Vitis (Cissus) hypoglauca*.
- x—*Vitis (Cissus) rhombifolia*.

Millettia megasperma, Benth., the "evergreen wisteria" from Austral. is a promising plant in California; woody climber: lfts. 7-13, obovate or obovate-oblong; fls. purple, in racemes 4-6 in. long which comprise a terminal panicle.

JOHN WM. GREGG.

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KATHERINE D. JONES.

PLÁTANUS (its ancient Greek name). *Platanóceæ*. PLANE-TREE. BUTTONWOOD. Ornamental trees with handsome dense foliage, often planted as shade and street trees.

Deciduous, with the bark exfoliating in thin plates, but at the base of older trunks the bark is persistent, of darker color and furrowed: stipules conspicuous, usually connate into a tube, with spreading lf.-like margin; petiole with the enlarged base inclosing the axillary bud: lvs. palmately lobed, covered densely with stellate hairs when young; fls. monoicous, in dense globular heads, staminate and pistillate similar, but on separate peduncles; sepals and petals 3-8; staminate with 3-8 stamens, pistillate with 3-8 pistils with elongated styles: fr.-heads consisting of numerous narrowly obconical, 1-seeded nutlets surrounded at the base by long hairs.—Six or 7 species are known in N. Amer., south to Mex. and from S. E. Eu. to India. The planes are handsome trees with large and

palmately lobed leaves and small greenish flowers in drooping heads, followed by similar heads of fruits remaining on the branches during the winter. The smooth light-colored often almost creamy white bark of the branches and limbs, usually mottled by darker blotches of the older bark, which peels off in large thin



3061. *Platanus racemosa*.
($\times \frac{1}{2}$)

plates, gives the tree a very characteristic appearance in winter, while in summer the plane-tree, with its large head of dense bright green foliage and with its massive trunk is a beautiful and majestic shade tree. The native *P. occidentalis* is hardy North and *P. acerifolia* and *P. orientalis* hardy as far north as Massachusetts, while the southwestern and Mexican species cannot be cultivated in the North. From time immemorial, the oriental plane, which was well known to the ancient Greek writers, has been famous for the large size it attains—trunks of 30 feet in diameter and more are reported to exist—and has been planted as a shade tree in western Asia and southern Europe, and today it is still one of the favorite street trees throughout the temperate regions of Europe. It has also been recognized in this country as one of the best street trees, even to be preferred to the native plane, which, unfortunately, suffers from the attacks of a fungus, *Glæosporium nervisequum*, while the oriental is not injured by it. The plane-trees stand pruning—even severe pruning—well. To what extent they are sometimes pruned in European cities without losing their vitality is shown in an interesting illustration in "Forest Leaves," Vol. III, p. 97. They are also easily transplanted even as larger trees. They grow best in a deep and rich moist soil. Propagation is by seeds sown in spring and only slightly covered with soil and kept moist and shaded; also by cuttings of ripened wood and by greenwood cuttings under glass in June taken with a heel, and sometimes by layers. Varieties are also sometimes grafted in spring on seedlings of one of the species. The stellate hairs of the young leaves when detached by the wind, sometimes float in great quantities in the air and are liable to cause irritation and sometimes inflammation of the mucous membranes of the eye, nose, and mouth. But as this is likely to occur only during a very limited period late in spring it can hardly be considered as a serious objection to the use of platanus as a street tree.

A. Fr.-heads 3 or more, in pendulous racemes.

B. Lobes 5-7, dentate or lobed.

orientalis, Linn. **ORIENTAL PLANE**. Tree, to 80 ft., with usually very broad and round head on a comparatively short trunk: bark of dull grayish or greenish white color: stipules small, usually with entire margin: lvs. usually broadly cuneate at the base, deeply 5-7-lobed, rarely 3-lobed, with the sinuses reaching almost to or below the middle; lobes longer or much longer than broad, coarsely toothed or entire, glabrous or nearly so at maturity, 4-8 in. long: fr.-heads 2-4 on long, drooping stalks, bristly, the nutlets narrowed at the apex into a persistent style to 2 lines long. May. S. E. Eu. to India. G.F. 4:91. G.C. III. 23:25, 27; 29:363. Gn. 1, p. 550; 20, pp. 369, 371, 373. F.S.R. 2, pp. 75, 77. F.E. 24:69. G.W. 14, pp. 688, 689. Var. *digitata*, Janko (*P. umbraculifera*, Hort., var. *laciniata*, Hort.). Lvs. cuneate or truncate or cuneate at the base, deeply 5-lobed, with narrow, elongated, coarsely toothed lobes. Gn. 1, pp. 572, 573; 20, p. 371. F.E. 18, p. 718, pl. 89. Var. *cuneata*, Loud. (*P. cuneata*, Willd.). Often shrubby: lvs. short-stalked, smaller, usually deeply 3-lobed and cuneate, with narrow-toothed lobes. Gn. 1, p. 618; 20, p. 371. G.C. III. 29:363.—The true oriental plane is rare in cult., the tree usually planted under this name being *P. acerifolia*.

BB. Lobes 3-5, usually entire.

racemosa, Nutt. (*P. californica*, Benth.). Fig. 3061 (adapted from Pacific R. R. Report). Tree, to 100 or 120 ft., with a trunk often divided into several sts.: lvs. usually cordate or truncate, deeply 3-5-lobed, thick and firm, deep green above, paler beneath and covered with a pale tomentum, 6-10 in. diam.; lobes ovate-lanceolate, entire or sometimes remotely or sinuately toothed: fr.-heads bristly or rather smooth, sessile, 2-7; nutlets tomentose while young, becoming glabrous. S. Calif. and Low. Calif. S.S. 7:328.

AA. Fr.-heads 1 or 2, rarely 3.

acerifolia, Willd. (*P. orientalis* var. *acerifolia*, Ait. *P. intermedia*, *P. integrifolia* and *P. macrophylla*, Hort. *P. damascena*, Dode). **LONDON PLANE**. Fig. 3062. Probably hybrid between *P. orientalis* and *P. occidentalis* and intermediate between the two, sometimes resembling



3062. *Platanus acerifolia*. (\times about $\frac{1}{4}$)

more the one and sometimes more the other parent. Tree, to 100 ft.: lvs. 3-5-lobed, usually truncate or broadly cuneate at the base, the lobes broadly triangular, coarsely toothed, the middle lobe as long or slightly longer than broad: fr.-heads usually 2, rarely 3, bristly or sometimes scarcely so. Of garden origin. G.C. III. 29:363. Gn. 1, p. 588; 20, p. 371 and probably 1, p. 486, and 20, p. 370 (as *P. occidentalis*). F.E. 24:69 (as *P. orientalis*). Var.

pyramidalis, Jaen. (*P. pyramidalis*, Bolle). Of pyramidal habit: lvs. usually 3-lobed, often longer than broad, with usually rounded base. Var. *tubifera*, Jaen. (*P. superba*, Hort.). With very conspicuous elongated, tubular stipules. There are also some forms with variegated lvs. Var. *Süttneri*, Hort., with the lvs. spotted and marked white, and var. *Kelseyana*, Schneid. (var. *albico-variegata*, Hort.), with yellow-variegated lvs.—The London plane is more generally planted under the name of the oriental plane than the true *P. orientalis*. It resembles in foliage more the American plane and is of more pyramidal habit than the oriental plane, which in its typical form has a broad head, with wide-spreading branches, deeply divided, 5-7-lobed lvs., and the fr.-heads usually in 3's and 4's. It is somewhat harder than the oriental plane.

occidentalis, Linn. BUTTONWOOD. BUTTONBALL. AMERICAN PLANE-TREE. Also wrongly called SYCAMORE. Fig. 3063. Large tree, attaining 130 or occasionally 170 ft., with a round-topped oblong or



3063. *Platanus occidentalis*. (X 1/4)

broad head and with a trunk 10 ft. or exceptionally more in diam., often of considerable height: bark of limb and branches of very light often almost creamy white color, at the base of the trunks dark brown, fissured: stipules large, with toothed margin: lvs. as broad or broader than long, truncate or cordate, rarely cuneate at the base, usually 3-, sometimes 5-lobed, with shallow sinuses; lobes shorter than broad, coarsely toothed or entire, floccose-tomentose when young, at maturity only pubescent on the veins beneath, 4-9 in. broad: fr.-heads solitary, rarely in 2's, on 3-6-in.-long peduncles, about 1 in. across or more, comparatively smooth at length; nutlets with obtuse apex, with the rest of the style 1/4 in. long or shorter. May. Maine to Ont. and Minn., south to Fla. and Texas. S.S. 7:326, 327. G.F. 2:354, 355; 9:55. Em. 1:261, 263. Gng. 4:343. Mn. 3, p. 69; 5, pp. 205, 209.—The most massive and perhaps the tallest of all deciduous trees of N. Amer. and an excellent street and park tree where it is not injured by fungous diseases. A doubtful variety is var. *hispanica*, Wesm. (*P. hispanica*, Lodd.). Lvs. large, 3-5-lobed, with very shallow sinuses, coarsely toothed, usually cordate at the base. Gn. 1, p. 588; 20, p. 370.—The *P. densicoma*, Dode (B.S.D. 1908:68), described as having usually truncate or broadly cuneate lvs. and 1-3 heads with acutish nutlets is probably not different from *P. occidentalis* or may belong to *P. acerifolia*.

P. vulgaris, Spach, comprises all species of the genus.—*P. Wrightii*, Wats. Tree, to 80 ft., often divided into several sts.: lvs. usually cordate or truncate, deeply 3-7-lobed, with lanceolate, acuminate, entire or dentate lobes, tomentose beneath or nearly glabrous at length, 6-8 in. long: fr.-heads racemose, rather smooth, each on a short stalk. New Mex. and Ariz. to Calif. S.S. 7:329.

The other species, as *P. mexicana*, Moric., which is sometimes

planted as a street tree in Mex., *P. Lindaviana*, Mart. & Gal., and *P. glabrata*, Fern., all natives of Mex., are not yet intro.

ALFRED REHDER.

PLATONIA (from a personal name). *Guttiferae*. Trees, little known as yet in cult.: lvs. leathery, closely and finely feather-veined: fls. large, rose, solitary, terminal, perfect; sepals 5, imbricate; petals 5, much larger than the calyx, scarcely convolute into an ovoid corolla; stamens 5; ovary 5-celled: fr. a fleshy indehiscent 5-celled edible berry. Two species from Brasil. *P. insignis*, Mart. Large tree: lvs. coriaceous, oblong, acute: fls. solitary, terminal, showy; sepals suborbiculate, 2 outer smaller; petals broad-ovate, rose outside, white inside; ovary ovoid: berry subglobose or oval. Brasil. Intro. and distributed by the U. S. Dept. of Agric.

PLATYCARYA (Greek for *broad*, and *nut*; alluding to the shape of the fruit). Syn., *Fortunba*. *Juglandaceae*. A monotypic genus distinguished from all other *Juglandaceae* by its fertile fls. forming an upright cone-like spike. Small deciduous tree: the branches with solid pith: winter buds with imbricate scales: lvs. odd-pinnate, similar to those of *Carya* *Pecan*, but smaller: staminate catkins axillary; pistillate terminal, solitary: fr. a small, winged nut in the axils of densely imbricated, rigid and sharply pointed lanceolate bracts forming a terminal upright cone. Rarely cult. and not hardy north of the Middle states. It has graceful foliage, but its ornamental value is not great. Prop. by seeds and by layers, probably also by grafting on *Carya*.

strobilacea, Sieb. & Zucc. (*Fortunba sinensis*, Lindl.). Small tree, with upright glabrous branches: lvs. 8-12 in. long; lfts. 9-17, sessile, oblong-lanceolate, falcate, acuminate, doubly serrate, pubescent only on the midrib beneath, 3-4 in. long: fr.-bearing cone about 1-1 1/4 in. long, oval, brown. Summer. Japan, China, S.Z. 2:149. F.S. 4, p. 326b. R.H. 1888, p. 88. J.H.S. 1846, p. 151. S.I.F. 1:17. ALFRED REHDER.

PLATYCERIUM (Greek, *broad horn*; alluding to the shape of the lvs.). *Polypodiaceae*. STAG-HORN FERN. An anomalous genus of ferns with irregularly lobed thick lvs. with the sori forming irregular patches over one or both surfaces. The sterile lvs. are flat, rounded expansions closely adherent in layers to the substratum. In their native forests these ferns grow to the surface of trees and old plants and often form enormous nests. A few kinds of *Platycerium* are offered for sale in Amer. European growers list others, new ones appearing from time to time, but the whole group is grown in America only as specimens in large collections. The word "disk," as used below, refers to the widest unbranched portion of the fertile frond.

The stag-horn ferns are amongst the most beautiful and distinct of ferns—perhaps the most striking of all—because of their noble antlered appearance and their epiphytal habit. They have two kinds of fronds, barren and fertile, the former being rounded disks which clasp the tree trunk, while the fertile fronds generally hang down and look like antlers. Occasionally the barren fronds are more or less antlered, as in *P. grande*, but never give so perfect a suggestion as do the fertile fronds. The species are all tropical, except *P. alciacorne*, which is therefore the easiest to grow and the commonest in cultivation. This species can endure a night temperature of 50° F. or even less. The glory of the genus, however, is *P. grande* (Fig. 3064). The barren fronds are exceptionally large, rounded, and wavy margined at the base, deeply cut above, forming an erect or arching background to the pendent fertile fronds, which fork more times and have much narrower segments than the barren fronds. Unfortunately this

is the only species that does not produce suckers at the roots, by which all the others are easily propagated. It alone must be raised from spores, a long and anxious process. The only kind that has an erect and rigid habit is *P. Hillii*, which therefore is grown in pots while all the others may be grown on a block of wood, and some in baskets. *P. biforme* differs from all others in having a separate and specialized structure on which the sori are borne, the other kinds bearing their spore-masses on the under surface of the fertile fronds at or near the last forks. *P. biforme*, though it has been advertised, is probably nowhere in cultivation in the world. There is an improved form of the common type known as *P. alciorne* var. *majus*, which is stronger-growing and has thicker fronds, enabling it to endure a drier atmosphere. It is therefore one of the best, if not the best, for exhibition purposes. At the other extreme from the slender grace of *P. alciorne* and the rest is the bold and broad style of *P. æthiopicum*. The only one which bears no resemblance to antlers is *P. angolense*. All the species require a moist atmosphere, though the humidity should be reduced during the winter. With the exception of *P. alciorne* they all demand a high temperature. All need perfect drainage, and in winter they should not have too much direct syringing, for they need a slight rest and are likely to spot or damp-off if water remains on the foliage too long. *P. æthiopicum* is said to be particularly sensitive. Stag-horn ferns are often grown on pieces of tree-fern stem. They are fastened to such support or to a board by means of wire, having first furnished the roots with a slit piece of peat for roothold and some sphagnum moss, to which may be added a little bone-meal for food and some charcoal for drainage. A little moss may be added every year or two. Eventually the barren fronds will entirely cover this material and the plants should then be left undisturbed for years. A stag-horn fern, with antlers spreading 6 or 8 feet, is a sight never to be forgotten. (W. H. Taplin and F. L. Atkins.)

A. Plants not forked like a stag-horn.

angolense, Welw. (*P. æthiopicum* var. *angolense*, Welw.). Fertile lvs. wedge-shaped in outline and merely wavy at the margin, not divided into lobes. It is also distinct by reason of felt-like covering of rust-colored wool on the lower side of the lvs. Barren lvs. large, erect; fertile lvs. attaining a length of 18 in. and a width of 9 in. at the top; spore-mass nearly as broad as the lf. Angola (W. Afr.). G.C. III. 23:155 (repeated in 28:444).

AA. Plants resembling a stag-horn.

B. Sori borne on a special receptacle.

biforme, Blume. According to Blume's plate and description, this differs from all other kinds in having the spores borne on a special appendage, which is kidney-shaped and attached below the first fork. Blume says there are 2 such appendages; that the barren lvs. are roundish, entire below, lobed above; fertile lvs. 3-5 ft. long, many times forked, pale green. Java.—The fertile lvs. of *P. biforme* are said to grow 15 ft. long sometimes. The picture in Gn. 4, p. 295, labeled *P. biforme* seems to be distinct and anomalous, though somewhat like *P. grande*.

BB. Sori borne on the last forks or near their base.

c. Barren lvs. stag-horn-like above.

D. Fertile lvs. in pairs.

E. Plants glabrous or nearly so.

grande, J. Smith. Fig. 3064. This may be readily distinguished from *P. alciorne* by its barren lvs., which are also stag-like, while those of *P. alciorne* are not. Barren lvs. stalkless; segms. blunt, spongy, pale green, tomentose; fertile lvs. in pairs, 3-6 ft. long; sori not at the base of every ultimate fork but against the

upper edge of the disk, with an infertile fork projecting beyond on either side. N. Austral. G.C. 1872: 1137; III. 8:97 (good, repeated in III. 10:698 and 28:433). Gng. 5:169 (same as A.F. 6:701). F. 1850:47 (same as F.S. 6, p. 156). Not G.M. 40:135, which is *P. æthiopicum*. Mn. 1, p. 77 (erroneously as *P. alciorne*).

EE. Plants pubescent, with yellowish wool.

Wällichii, Hook. As in *P. grande*, the sori are borne not at the base of the ultimate forks, but on a disk which is not squared off at its upper surface but rounded and projecting into the angle between the forks; sori roundish. Malay Penins. G.C. III. 28:435. Hook. Fil. Exot., pl. 97.



3064. *Platycerium grande*.

DD. Fertile lvs. in 3's.

Willinckii, Moore. Distinguished from *P. grande* by the sori, which nearly fill the last forks but do not approach the base of the sinus. The lvs. are thinly furnished with minute stellate hairs, at length glabrous and pale green. Moore says: "fertile fronds in 3's, elongate, pendent, with scarcely any disk, bipartite for about two-thirds of their length, one of the margins of each primary branch entire, the other bearing numerous lobes in about three series on a dichotomous plan." Strong features of this plant are the length, narrowness and acuteness of the forks, and also the narrowness of the "disk" or unbranched portion just below the primary forks. Java. G.C. II. 3:303 (repeated in III. 10:701 and 28:431). A.G. 15:111. Gn. 10, p. 383 (repeated in Gn. 30, p. 300).

CC. Barren lvs. not stag-horn-like, entire or merely lobed.

D. Segms. and sinuses of the fertile lvs. very broad.

æthiopicum, Hook. (*P. Stemmària*, Beauv.). Barren lvs. rounded; fertile lvs. 2-3 ft. long, clustered, pendent, twice dichotomous (not twice trichotomous, as some writers say); sorus a V-shaped patch surrounding the sinus. Guinea, Angola. Hooker's Garden Ferns, pl. 9. A.G. 15:111. G.M. 40:135 (erroneously as

P. grande).—The fronds are said to be covered below with a thin cottony down.

DD. *Segms. and sinuses narrow.*

E. *Unbranched portion of fertile lvs. very long and narrow.*

Hillii, Moore (*P. alcicorne* var. *Hillii*). Barren lvs. like *P. alcicorne*, but the fertile lvs. are erect, the unbranched portion longer, the forks more numerous and compact, the segms. shorter and more acute. Lvs. clustered thinly, covered when mature with white stellate hairs; sori in oval or roundish masses, not at the base of the sinus but near the base of each of the last segms. The upper third of the fertile lf. is "15-18 in. across, 3-parted, the central segms. with 1 or 2 side lobes near the apex, the 2 lateral segms. broader and twice or thrice forked into 5-10 ultimate lobes."—T. Moore. Queensland. G.C. II. 10:51, 428, 429. J.H. III. 32:497.

EE. *Unbranched portion of fertile lvs. moderately long.*

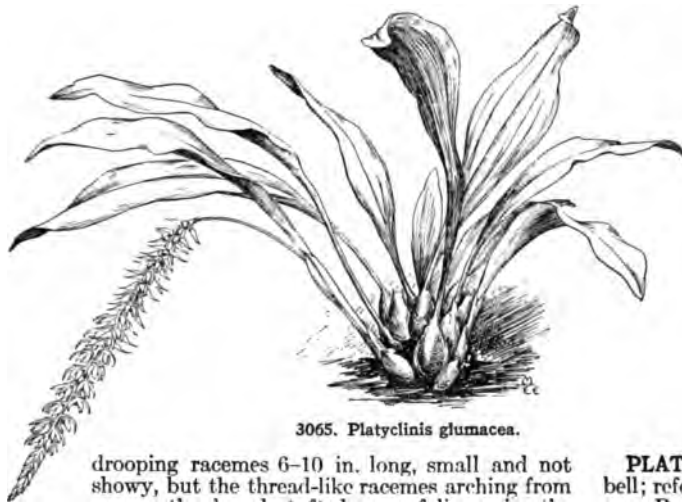
alcicorne, Desv. Barren lvs. rounded, convex, wavy margined; fertile lvs. clustered, attaining 2-3 ft., 2-3 times dichotomous, the unforked portion erect, the segms. pendent, rather narrow and sharply cut, under surface covered with thin cottony down: sori in irregular masses filling the last forks and a space across their bases, shown in B.R. 262, 263 (as *Acrostichum alcicorne*). Temp. Austral. A.G. 14:153; 15:111. Gn. 51, p. 259. G.C. III. 10:697. Not Mn. 1, p. 77, which is really *P. grande*.

Var. *majus*, Moore, is stronger-growing, more upright, and with thick, leathery, dark green lvs. According to F. L. Atkins, the fertile lvs. are more broadly cut than the type and seldom forked more than once. Polynesia. Veitch's Catalogue in 1873, p. 13.

WILHELM MILLER. R. C. BENEDICT.†

PLATYCLINIS (Greek, *broad bed*; in allusion to the clinandrium). *Orchidaceæ*. Epiphytic orchids, suitable for a warm greenhouse. These plants are by recent orchid students referred to *Dendrochilum*. In this account, the names under that genus are given in the parentheses.

Pseudobulbs small, closely crowded, each with a single, narrow, evergreen lf.: fls. borne in graceful,



3065. *Platyclinis glumacea*.

drooping racemes 6-10 in. long, small and not showy, but the thread-like racemes arching from among the densely tufted green foliage give the plants a pleasing appearance; sepals and petals spreading; labellum 3-lobed; column short, with an erect-toothed clinandrium and a large, narrow, erect wing on each side of the clinandrium.—About 20 species in India, China, and the Malay Isls.

The several species of *Platyclinis* are all small com-

pass-growing plants, requiring but little root-space. They are of easy culture and readily adapt themselves to either pot or basket culture, the latter being preferable for those with pendulous flower-scapes. The roots do not like being disturbed, but when repotting is necessary it is best to do it just after the flowering period. The compost should consist of equal parts chopped live sphagnum moss and clean peat fiber. The roots should be carefully distributed and the compost pressed gently but firmly in around them, leaving the surface slightly convex when finished. At least two-thirds of the space should be devoted to free drainage with potsherds or bits of charcoal. A shaded location and moist atmosphere, with a temperature of 60° to 65° F. by night and 70° to 75° by day, will afford them satisfactory growing conditions. They require a liberal supply of water at the roots, with occasional syringing overhead in bright weather when growing, and should never be allowed to remain long dry even when at rest. The plants frequently produce side growths from the old pseudobulbs, which may be removed after the growths are matured, leaving three or more of the old pseudobulbs attached to each piece, thus increasing the stock. When no natural break occurs, however, the plants may often be induced to break by slightly twisting, or notching the rhizome with a sharp knife, thereby retarding the flow of sap at that point. (Robert M. Grey.)

glumacea, Benth. (*Dendrochilum glumaceum*, Lindl.). Fig. 3065. Pseudobulbs crowded, forming dense spreading masses, the young ones clothed with red scales; lvs. solitary, broadly lanceolate, tapering to a petiole which is inclosed by the sheath; peduncle from the top of the pseudobulb, slender, bearing a long drooping spike of small white fls.; sepals and petals spreading, oblong, acuminate; middle lobe of the labellum rotund, curved, base with 2 fleshy ridges. Spring. Philippines. B.M. 4853. G.C. III. 18:552. G.M. 48:385. Gn.W. 16:665.

filiformis, Benth. (*Dendrochilum filiforme*, Lindl.). Pseudobulbs crowded: lvs. linear-lanceolate: fl.-st. thread-like, bearing a long, pendulous raceme of small, pale yellow fls.; sepals and petals obovate; labellum cuneate-rotund, auriculate at the base. Summer. Philippines. I.H. 25:323 (as *Dendrochilum glumaceum*). G.F. 2:485.

Cobbiàna, Hemsl. (*Dendrochilum Cobbiànum*, Reichb. f.). Lvs. oblong-lanceolate: fls. in a zigzag raceme, pale yellow, with an orange lip; sepals and petals triangular-oblong; labellum cuneate-fan-shaped, retuse. Nov., Dec. Philippines. O. 1914, p. 123.—This is offered in some catalogues under the name of *P. autumnalis*.

P. barbifrons, Kränzl. Lvs. lanceolate, acute, 5-7 in. long, about 1 in. broad: racemes very slender, pendulous, many-fl.; fls. greenish white, about ¼ in. across; sepals and petals similar, ovate-lanceolate, acuminate; lip entire, obovate, apiculate. Sumatra. G.C. III. 31:366 (desc.).—*P. cucumerinum*, Hort. (*Dendrochilum cucumerinum*, Reichb. f.). Lvs. long-petiolate, oblong, 5-nerved, up to 5 in. long, less than ½ in. wide: scape slender, exceeding lvs., with a pendulous raceme; fls. pellucid-green; sepals oblong, acute, ½ in. long; petals similar, denticulate, lip 3-toothed. Philippines.—*P. latifolia*, Hemsl. Pseudobulbs 1-lvd.: lvs. elliptic-lanceolate, 10 in. long, 7-nerved: raceme many-fl., pendulous, on an erect scape; fls. greenish yellow; sepals triangular-lanceolate, acute, ¾ in. long; petals ovate-lanceolate, acute, denticulate; lip brown-striped. Philippines.

GEORGE V. NASH.

PLATYCÖDON (Greek, *platys*, broad, and *kodon*, bell; referring to the shape of the flower). *Campanulacæ*. Perennial smooth erect glaucous herbs, which are used in border planting.

Leaves sparse, often opposite or whorled, sessile, dentate: fls. large, solitary or few at the ends of the branches; calyx-tube adnate, turbinate, 5-lobed; corolla campanulate, 5-lobed; stamens free from the corolla; ovary inferior, 5-celled: caps. obovoid, top

conical, loculicidal within the lobes of the calyx, 5-valved.—One species, E. Asia and Japan. This plant was first placed in Campanula by Jacquin, and later, by Schrader, in Wahlenbergia; and it is still sometimes cult. under these names. In 1830 it was made a separate genus (Platycodon) by A. DeCandolle. It is distinguished from Campanula by its broadly cup-shaped fls., the stamens dilated at the base, and the caps. opening at the top and not at the sides.

From Wahlenbergia it differs in the valves of the caps. being opposite to the calyx-lobes instead of alternate with them. Several supposed species have been described at different times, but there seems to be no doubt that the genus is distinctly monotypic and that all forms can be referred as forms of the type *P. grandiflorum*, which has been widely distributed and thereby greatly modified. It has been found in a wild state from Dahuria to Manchuria, in China, in Siberia, Korea, and Japan.

Platycodon requires a medium sandy loam, and does not succeed in either extremely stiff or sandy soils. It is particularly sensitive to ill-drained soils. Under suitable soil conditions it is perfectly hardy and will even stand considerable neglect. It is desirable to keep the stems tied during the season, for if once allowed to fall they can never be raised without breaking. In autumn the old stems should not be cut away, but the plant allowed to die off naturally; otherwise the crown may be injured. It can be propagated either by division or by seeding, the latter being more surely successful and therefore preferable; besides, a greater variety of flowers is obtained in this way. More care and skill are necessary in propagation by division, because of the fleshy rootstock. It is best accomplished in spring, when the plant is breaking into new growth.

One of the best single varieties of *P. grandiflorum* is "Die Fee," large and very free-flowering, sky-blue. Of the numerous semi-double and double sorts may be noted Goos & Koenemann's German introductions: Capri, deep blue, medium tall; Multiflora, with thickly set clear blue bells; Seidenball, lilac-purple, and the dark blue Vineta. Of French origin are Cloche bleue, navy blue, and Globe azuré, sky-blue. (Richard Rothe.)

grandiflorum, DC. (*Campanula grandiflora*, Jacq. *Wahlenbergia grandiflora*, Schrad.). CHINESE OR JAPANESE BELLFLOWER. BALLOON FLOWER. Fig. 3066. Plant 1–2 ft. high, forming a dense, branching bush of upright habit: lvs. lanceolate or ovate-lanceolate, glabrous, unequally toothed: fls. large and open, attaining 3 in. diam., produced from tips of branches, inflated in the bud, hence sometimes called "balloon flower;" corolla 5-lobed, blue, pale blue-white, or variegated. June, July. G.C. III. 28:223. J.H. III. 30:123; 54:331. F.S. 22:2332. B.M. 252. F.E. 15:647. G. 30:421. Gn.W. 6:713. R.B. 39:347. Var. *album*, Hort. A white-flowering form. Var. *autumnale*, Voss. (*P. autumnale*, Decne.). Later-flowering form from Man-



3066. *Platycodon grandiflorum*. (X $\frac{1}{4}$)

churia. Gn. 45, p. 462. R.H. 1848:361; 1858, p. 547. G. 2:211. H.F. 8:172. J.F. 3:250.

Var. *japonicum*, Hort. (*P. japonicum*, Hort.), is of stronger and bushier growth and freer-flowering. The fls. average 2½ in. across; the inner and outer lobes alternate with one another, giving the fl. the appearance of a 10-pointed star.—This variety was first procured by Dreer in 1895 from Leonard Lille, Lyons, France, who offered it as a novelty that season. It proved to be a first-class and desirable sort and has been tested by Dreer since, who considers it one of the good hardy perennials.

Var. *Mariëssii*, Hort. (*P. Mariëssii*, Hort.). Originally intro. into England from Japan by Mariës, and supposed to be identical with var. *glaucum* of Siebold. It does not exceed 1 ft. in height: growth stouter and more compact: lvs. thicker than in the type: fls. are as large or larger than the type and varying in color from deep purplish blue to pale blue or lavender and white. G.C. III. 14:163. G.M. 37:35. J.H. III. 35:29; 63:152. Gn. 27:216; 45:462. A minor form of var. *Mariëssii*, var. *nana*, Hort., is frequently offered in the trade as being dwarfer and more compact, with white or blue fls. Var. *sémi-duplex*, Hort. Two and one-half ft. high: fls. rich blue, darker veined, 2½–3 in. across, flattened, and with a second row of corolla-segms. G.M. 43:575. G.C. III. 28:223. Var. *sémi-plénum*, Hort. Fls. semi-double, and varying in color from purple to white; said to have been developed from var. *album*. Var. *striatum*, Hort. A garden form with blue or white fls., striped with white or blue.

ARNOLD V. STUBENRAUCH.
F. TRACY HUBBARD.†

PLATYCRATER (Greek, *platys*, broad, and *crater*, bowl; alluding to the broad enlarged calyx of the sterile fls.). *Saxifragaceæ*. A monotypic genus allied to Hydrangea. The species is a woody plant, with opposite serrate lvs. and white, comparatively large fls. in long-peduncled, loose cymes, the marginal ones sterile and with enlarged calyx; petals 4; stamens numerous: fr. a 2-celled many-seeded dehiscent caps. It is not hardy N. and of little decorative value. It thrives best in rather moist, porous soil and partly shaded position and is easily prop. by seeds, greenwood cuttings under glass, or layers.

arguta, Sieb. & Zucc. Prostrate shrub: lvs. oblong to oblanceolate, cuneate at the base, acuminate, glabrous except on the veins beneath, thin, light green, 3–6 in. long: cymes 3–10-fl., on a 1–2-in.-long peduncle; fls. slender-pedicelled, the sterile ones apetalous, 1 in. across, with broad, obtuse sepals; fertile smaller, with lanceolate sepals half as long as the oblong-ovate petals. July. Japan. S.Z. 1:27. Gt. 15:516. H.F. 1870:206.—Useful for rockwork in greenhouses.

ALFRED REEDER.

PLATYLEPIS (Greek, *broad scale*; presumably referring to the fact that the sepals are broad). *Orchidaceæ*. Terrestrial herbs with creeping rhizomes and ascending leafy sts., suitable for the warmhouse: lvs. petiolate, ovate or ovate-lanceolate, membranous: fls. narrow, shortly pedicelled, arranged in dense spikes; bracts ovate; sepals subequal, narrow, free, connivent round the column; lateral united at the base into a very short chin.; petals narrow, slightly cohering with the dorsal sepal into a hood; lip sessile at the base of the column, erect, channelled, broadly ventricose at the base, cohering with the margins of the column; limb very little dilated; column elongated, subterete, clinandrium oblong, erect behind the rostellum. About 6 species, Trop. and S. Afr. *P. australis*, Rolfe. Lvs. ovate, 2–4 in. long, 15–21-nerved: infl. erect scapes 6–12 in. long, bearing an oblong or elongated many-fl. raceme 2–5 in. long; fls. small, green, with the upper half of the lip white. S. Afr. *P. densiflora*, Rolfe. Differs from the preceding in having narrower sepals, the

lateral not reflexed in the middle, narrower petals, and a lip not constricted in the middle. Mascarene Isls. Both species have been intro. at Kew Gardens, but probably are not in general cult. Stovehouse plants.

F. TRACY HUBBARD.

PLATYLÔMA is a name for ferns of the genus *Pellaea* which have a narrow indusium and a broad sorus. For *P. Bridgesii* and *P. falcata*, see *Pellaea*.

PLATYSTEMON (Greek, *broad, thread*; referring to the broadened filaments). *Papaveraceae*. Low annual herbs generally branched at the base, sometimes grown in flower-gardens.

Stems erect or decumbent, glaucescent: lvs. alternate or subopposite, linear- or oblong-lanceolate: fls. usually erect and solitary; sepals 3, ovate, caducous; petals 6, sometimes more, yellowish white or yellow or white, caducous or rarely persistent; stamens numerous; ovaries 6-20, distinct: fr. at maturity many carpels totally distinct or slightly joined, carpels moniliform.—About 60 species natives of the Pacific Coast according to Fedde (Engler's *Pflanzenreich*, hft. 40. IV:104), or 1 species according to Gray and a large number of American authors. *Platystemon* grows wild throughout Calif., except in the mountains, and is said to prefer a loose soil.

californicus, Benth. (*P. leiocrpus*, Fisch. & Mey.). **CREAM-CUPS**. Lvs. appearing opposite, sessile, ligulate-linear: petals light yellow, cream-color or white: carpels linear, moniliform, sometimes hispid. B.M. 3579. B.R. 1879. B. 2:65. Gn. 30, p. 313. G. 34:397.—*P. leiocrpus*, Fisch. & Mey., is the smooth-fruited form and is considered by some to be a distinct species, but is said by Gray in the Synoptical Flora to be "a mere state." F.C. 2:76. B.M. 3750.—*P. californicus* is frequently improperly called the California poppy but the true California poppy is *Eschscholtzia californica*.

F. TRACY HUBBARD.

PLATYSTIGMA (Greek, *broad stigma*). *Papaveraceae*. Low slender California annuals with pale yellow fls. less than 1 in. across. They are among the few plants of the poppy family with entire lvs. They are closely allied to *Platystemon*, but differ in having the filaments scarcely dilated, 3 stigmas instead of many, and the fr. a caps. which is 3-valved at the apex. Fls. commonly trimerous; stamens numerous, free; stigmas not confluent. Four species from Calif. and Ore. *P. lineare* is the only one with thick stigmas and also differs in its tufted habit, the others having leafy and branching sts. B.M. 3575, with pale yellow fls.; in B.R. 1954 it is shown with 3 white petals alternating with yellow ones. *Platystigmas* seem not to have been offered in Amer. By Fedde the species are referred to other genera.

PLATYTHÈCA (Greek, *broad anther-cells*). *Tremandraceae*. Small shrub, somewhat heath-like, suitable for greenhouse culture.

Leaves whorled: fls. 5-merous, numerous, borne toward the end of the branches, light purple, about 1 in. across, center marked with a red star; stamens distinctly in 2 rows, anthers continuous on the same plane as the filament, with 4 parallel cells; disk inconspicuous: caps. loculicidally dehiscent, 4-valved. One species. Austral.—*Platytheca* belongs to a small beautiful and distinct family of Australian shrubs, composed of 3 genera, of which *Tetratheca* is the dominant type. The *Tremandra* family resembles the *Polygala* family in the structure of the caps., but differs in the regularity and estivation of the fl.; it resembles the *Pittosporaceae* in having a very small embryo immersed in copious albumen, and particularly the genus *Cheiranthra* in having anthers which open by a pore at the top. The three genera of *Tremandraceae* are distinguished from one another by the anthers; *Tremandra* differs from the

other two in having the anthers jointed with the filaments; in *Platytheca* the anthers have 4 cells all in the same plane; in *Tetratheca* the anthers are 2-celled or 4-celled, with 2 cells in front of the 2 others.

galioides, Steetz (*P. verticillata*, Baill.). Lvs. linear, $\frac{3}{4}$ in. long, about 10 in a whorl, hairy. Said to bloom in June. P.M. 13:171 (as *Tetratheca verticillata*). G.C. III. 44:290.—This plant deserves to be better known. Cuttings of half-ripened wood root freely under a bell-glass in a shaded house at 60°. Cuttings rooted in February or March will make good plants in 5-inch pots in one year. In summer keep them plunged outside, but covered with shaded sash. By trimming frequently they will make well-shaped plants, needing no supports. Kept in a coolhouse (45°) during winter, they will be covered with bloom in March and April. The fls. last but a short time, but the plant is so free that it is always covered with the blue bloom.

H. D. DARLINGTON and WILHELM MILLER.

PLECTOCÔMIA (Greek, *plaited hair*; application obscure). *Palmaceae*. Six species of East Indian climbing pinnate palms which fruit once and then die.

One of the most interesting species is *P. khasyana*, which is figured in B.M. 5105 under the erroneous title of *P. assamica*. This species has a slender st. 60-80 ft. long, and about as thick as a man's arm, being slightly thicker above than at the base. The lvs. attain 30 ft. and are pinnate only in the lower half, the rest of the lf. being a long whip-like extension of the rachis of the lf. A singular feature of this palm is the device by which it climbs. This consists of a series of compound spines shaped like a downward-pointing human hand, the back of the hand being yellow and the 5 or 6 fingers composed of brown spines. These organs are scattered all along the lower side of the flattened rachis. They hook on the branches of trees and thus enable the palm to climb for light. Probably all the species possess these flagelliform lvs. and remarkable spines. The whip-like lf.-tips may act as tendrils. The genus is little known to cultivators. It is allied to the rattans (*Calamus*), which also are climbers.

elongata, Mart. & Bl. Lvs. large; lfts. 1-1 $\frac{1}{2}$ ft. x 2 in., sparsely white powdery beneath, with 3 very slender parallel nerves or costae: fr. 1 in. diam., villous. Penang, Sumatra, Java.—Offered in 1890, but never much cult. in Amer. and probably not outside of botanic garden collections.

PLECTRANTHUS (Greek, *spur flower*; alluding to the swollen base of the corolla-tube). *Labiatae*. Herbs and subshrubs, bearing rather small flowers ranging from blue and purple to lilac; sometimes planted for ornament in warm countries.

Inflorescence various; calyx 5-toothed, the teeth equal or variously 2-lipped; corolla-tube exserted, swollen behind at the base; limb 2-lipped; stamens 4, filamentless, free: nutlets ovoid or oblong, smooth minutely punctulate.—About 120 species from the tropical and subtropical regions of Afr. and Asia, Japan, Austral., and Polynesia. The genus is closely allied to *Coleus*, being distinguished by having stamens free instead of united at the base into a tube which is distinct from the corolla. In other respects the genus has wide limits of variation. Sometimes called cockspur-flower. Prop. by cuttings which root easily.

fruticulosus, L'Hér. South African shrub, 3-4 ft. h. lvs. 4 in. or more long, petiolate, broadly ovate, dotted: racemes laxly panicked; whorls about 3-6: fls. blue; pedicels $1\frac{1}{2}$ in. long; corolla-tube spurred above the base; fruiting calyx declinate.—Said to be an elegant shrub; a specimen reported at Los Angeles 4 ft. high and 6 ft. through.

P. alboceruleus, N. E. Br. A tall branched herb with broadly ovate lvs. 2-4 in. long: racemes crowded, spike-like; corolla

and bluish. Trop. Afr.—*P. chiradzensis*, Baker. About 3 ft. high, with slender branches: lvs. petioled, toothed not unlike those of the common nettle: fls. in terminal loose panicles 6 in. long, long-lipped and light blue; fls. in winter. Trop. Afr.—*P. ciliatus*, E. Mey. St. covered with purple hairs: lvs. broad, bright green above, purple-red beneath: fls. white with purple spots. S. Afr. Intro. into Italy.—Said to be a showy autumn- and winter-flowering plant with a compact habit.—*P. Coppinii*, Neck. A quick-growing species with root-tubers and also aerial ones produced in the axils of the branch-nodes. Trop. Afr. This species is cult. and the produce sold for food in the Soudan.—*P. crassus*, N. E. Br. A stout subshrub, covered with velvety hairs: lvs. ovate, 3-6 in. long, short-petioled, crenate, upper surface rich velvety green, under surface gray with prominent reticulate venation: fls. in stout erect terminal panicles 1 ft. or more long, purple-blue. Trop. Afr. B.M. 8030. Gn. 73, p. 629.—*P. Mahonii*, N. E. Br. Sta. 3 ft. high: lvs. ovate, 3-4 in. long, petiolate, the lower cuneate, the upper cordate at the base, toothed: racemes 3-8 in. long, loosely many-fl.; fls. rather small, violet-blue. Trop. Afr. B.M. 7818.—*P. sacculus*, Benth. Subshrubby and rather succulent, with horizontally spreading branches about 1 ft. long: lvs. 2-3 in. long, ovate, coarsely toothed: racemes erect, simple, lax-fl.; corolla large, pale blue. Natal. B.M. 7841. Intro. into English botanic gardens and said to be a very ornamental species with probably the largest fls. of the genus.

F. TRACY HUBBARD.

PLECTRONIA (Greek, *cockspur*; referring to the spines). *Rubiaceae*. Woody plants sometimes cultivated in warm regions for the ornamental flowers. They are more or less spiny and have somewhat funnel-shaped 5-parted fls., with reflexed segms. valvate in the bud, and a hairy or naked throat; calyx obovate or oblong; stamens 5, in the throat; style short; stigma subcapitate, of 2 approximate lamellae: berry obovate-oblong, compressed, didymous, 2-stoned; stones indehiscent, 1-seeded.—About 150 species of shrubs or small trees, found in the Old World, mostly in the tropics.

spinosa, Klotzsch. Very spiny S. African shrub, 5-8 ft. high: lvs. fasciculate, oval or obovate, obtuse, entire, 1-1½ in. long: racemes or panicles shorter than the lvs.: peduncles axillary, 5-12-fl.; corolla-tube shorter than the limb; throat naked.—Intro. into S. Calif.

PLEIOCÁRPA (Greek, *many fruits*). *Apocynaceae*. Glabrous shrubs or small trees, grown under glass for the bloom: lvs. opposite or ternate, leathery: fls. in sessile axillary and often opposite clusters, very rarely in compact panicles or false umbels; calyx small, glandular; sepals 5, almost or quite free, obtuse or acute; corolla salver-shaped, tube slightly widened below the mouth, lobes 5, overlapping to the left; carpels 2-5, distinct: fr. fleshy, berry-like mericarps, leathery when dry, 1- or 2- (rarely 3-) seeded. About 10 species, Trop. Afr. *P. mítica*, Benth. Shrub 5 ft. high: lvs. opposite, elliptic or oblong, 3-6 in. long, thinly coriaceous: fls. in dense axillary, globose clusters; sepals ovate; corolla pure white, tube cylindric, ¾ to ¾ in. long, lobes ovate or oblong. B.M. 8343. G.C.III. 49:242. Cult. in botanic gardens abroad: The plant likes heat and moisture and about the same treatment as given ixoras.

PLEIOGYNIUM (Greek, *many and wives*, meaning not clear). *Anacardiaceae*. Tree recently intro. by the U. S. Department of Agriculture for experimental purposes. Lvs. odd-pinnate; lflets ovate, wedge-shaped at base: fls. dioecious, in numerous axillary racemes, those with male fls. as long as the lvs., those with female fls. shorter; petals obovate; stamens 10; ovary in female fls. 5-10-12-celled: drupe somewhat compressed, broad-top-shaped. One species, Queensland, Austral. *P. Solandri*, Engl. Tree, 40-60 ft. high: trunk occasionally very thick, 2-3 ft. diam.: lflets 7-9, obliquely ovate or oblong, obtuse, 2-3 in. long, entire: fls. sessile, densely clustered in short axillary racemes, rarely panicles; petals 5, spreading. Queensland.—The timber when first cut is soft, but afterward becomes hard and tough. Possibly may be used as stock for less hardy anacardiaceous fr.-bearing trees. Its adaptabilities in N. Amer. are not yet known.

PLEIONE (from Greek mythology: *Pleione*, mother of the Pleiades). *Orchidaceae*. A small group of orchids related to *Calogyne*, and requiring similar treatment.

Pseudobulbs soon dying: lvs. thin, deciduous, falling usually after the pseudobulbs are matured: fls. large, brightly colored, one or two borne on short scapes, produced from base of pseudobulbs.—About 13 species (Pfitzer & Kränzlin, Engler's Pflanzenreich, hft. 1907), of the mountains of India, extending to elevations where snow and frost are not uncommon. Few are cult. in Amer.

maculata, Lindl. Pseudobulbs round, flattened, depressed at the top, forming a fleshy ridge around the summit: lvs. lanceolate, from inflated sheaths: fls. preceding the lvs., on short peduncles; sepals and petals lanceolate, spreading, white; labellum funnel-shaped, with 5-7 fringed lamellae extending the entire length of the labellum side lobes streaked with purple, middle lobe ovate, wavy, white, spotted with purple and yellow.

The lvs. fall in Sept.; fls. in Nov. B.M. 4691. F.S. 14:1470. F. 1851:97 (all as *Calogyne maculata*). Var. *Bermánica* was once offered by Wm. Mathews.

præcox, D. Don (*P. Wallichiana*, Lindl. & Paxt.). Fig. 3067. Pseudobulbs flask-shaped, depressed, dull green, warted and covered with a network of the old split sheaths: lvs. broadly lanceolate, plicate: fls. large, on short peduncles; sepals long, lanceolate, spreading, pink; petals similar but narrower; labellum trumpet-shaped, indistinctly lobed, pink, white and yellow in the throat; disk with longitudinal fringed



3067. *Pleione præcox*. (×¼)

lamellae, margin dentate-fimbriate. Oct., Nov. B.M. 4496. B.R. 26:24. P.M. 6:25 (all as *Calogyne Wallichiana*). G. 32:743. J. I. 2:153. O. 1914:72.

lagenaria, Lindl. & Paxt. Pseudobulbs clustered and depressed, as in the other species, dull green, mottled with brown: fls. about 4 in. across, rose-lilac; sepals and petals narrowly lanceolate; labellum convolute, crisp on the margin, pale lilac, blotched with yellow and deep crimson in the throat and having several yellow crests. Aug.-Nov. Himalaya Mts. B.M. 5370. F.S. 23:2386. I.H. 14:510 (all as *Calogyne lagenaria*). Gn. 51, p. 64. O. 1914, p. 77.

Reichenbachiana, T. Moore. Pseudobulbs 5-8-grooved, flask-shaped but suddenly contracted at the top: scape 1-2 in. long, closely sheathed; sepals and petals linear-oblong, pale purple to white; labellum nearly white, middle lobe white with few pale purple spots, with 3 crests; margin ciliate-toothed. Autumn. Rangoon. B.M. 5753.

P. Hookeriana, T. Moore. Pseudobulbs seldom over 1 in. high: lvs. small, produced with the fls.: fls. 2-2½ in. across, rose-purple; lip lighter; throat pale yellow. Sikkim. O. 1914, p. 75.—*P. himalaia*, D. Don. Pseudobulbs 1-lvd.: lvs. up to 8 in. long, 1½ in. wide: scape 1- or rarely 2-fl.; fls. nodding; sepals lanceolate, somewhat acute, white, 1½-2 in. long; petals similar, white, obovate from a cuneate base; lip emarginate, the disk yellow, brown-spotted. Trop. Himalayas. J.F. 2:158. B.M. 5674.—*P. pogonioides*, Rolfe. Fls. terminal, showy, rose red with a whitish disk; sepals and petals somewhat connivent, oblong-lanceolate, about 1½ in. long; lip large, convolute around the column. China. B.M. 8588.—*P. Schilleriana*, Pfitz. & Kränzlin. Pseudobulbs 2-lvd.: fls. yellow, with

lip spotted purple or orange-red; lip deeply 3-lobed. Moulmein. O. 1914, p. 78.—*P. yunnanensis*, Rolfe. Fls. rose or purple; sepals and petals similar, $1\frac{1}{2}$ in. long, about $\frac{1}{2}$ in. broad, oblong-obovate; lip broadly cuneate, 3-lobed, about $1\frac{1}{2}$ in. long and broad. Yunnan. B.M. 8108. G.C. III. 41:152; 59:161. G.M. 49:781. J.H. III. 52:251. O. 1914, p. 79.

GEORGE V. NASH.†

PLEIOSPERMIUM (from the Greek for *many* and *seed*). *Rutaceae*, tribe *Citrez*. Small trees distantly related to *Citrus*, but having fruits filled with mucilaginous pulp. *Limonia* § *Pleiospermium*, Engler, 1896.

Leaves trifoliate, bifoliate, or unifoliate; spines straight, singly or in pairs in the axils of the lvs.: fls. in terminal panicles or axillary clusters; ovary 5-celled with 2 ovules in each cell.—Two species are known, ranging from India and Ceylon to Java. Both species of *Pleiospermium* are small trees, and both should be tested as stocks upon which to graft the common citrus frs. So far, attempts to intro. living seeds of *P. alatum* from India to this country have failed, possibly because of the large size and soft texture of the seeds.

alatum, Swingle (*Limonia alata*, Wight & Arn.). **TUMPAT-KURUNDU**. Small tree, common in S. India and Ceylon, especially in the dry regions: small branches, spineless or with spines 1 in. long: lvs. trifoliate; lfts. obovate, petioles winged: fl.-buds downy: fls. 4-5-parted, short-pedicelled in terminal or axillary panicles: fr. globose, 5-celled with 2 rather large seeds or rudiments of seeds in each cell, imbedded in a mucilaginous pulp. Ill. Wight, Ill. Ind. Bot., pl. 41.—The wood is hard and close-grained, much like that of *Chalcas exotica*.

dubium, Swingle (*Limonia diphyla*, Houttuyn(?). *L. dubia*, Blume. *Paramigyna Blumei*, Hassk.). **KIDJEROEKAN**. A small tree, native to Java, 9-12 ft. in height, branching out about 4-5 ft. from the ground, and having numerous suckers at the base: branches spiny or spineless: lvs. unifoliate, bifoliate, or trifoliate; petioles slightly winged: fls. in short axillary clusters of 5-15; ovary pubescent: frs. the size of a pigeon's egg, filled with unpleasantly aromatic resin secreted by pulp vesicles 3-4 mm. long. See Journ. Wash. Acad. Sci. 6, No. 13. WALTER T. SWINGLE.

PLEOCNEMIA: *Dryopteris*.

PLEROMA: *Tibouchina*.

PLEUROSPIERMUM (Greek *ribs* and *seed*, referring to the strong ridges on the fr.). *Umbelliferae*. Biennial or perennial herbs, tall or low, and glabrous, hardy and somewhat ornamental: lvs. pinnate or compound-pinnate, segms. ovate, dentate, incised, or divided into narrow segms.: umbel composite, many-rayed; involucre and involucral bracts many, often membranaceous or lf.-like: fls. white or dark purple; calyx-teeth small, ovate, or rarely obsolete; petals large for the family, obovate or cuneate: fr. oblong, ovoid, or subglobose.—About 45 species, a few in Eu., mostly in Asia, sometimes planted for ornament.

austriacum, Hoffm. Perennial, 2-3 ft. high: st. upright, striate: lvs. dark green, rather thick, shiny, 2-3 times pinnatifid, the lower petioled, triangular in outline, the upper more or less sessile: umbel flat, up to 40 rays; calyx weakly toothed, the teeth short and obtuse; petals white, clawed, broad ovate, acutish. Eu.

PLEUROTHALLIS (Greek, *lateral branch*; referring to the inflorescence, which arises from the axil of the leaf). *Orchidaceae*. Epiphytic orchids which on account of their small inconspicuous flowers are of no particular horticultural value, and not generally cultivated, although interesting.

Stems clustered on the rhizome, sheathed with scales below and bearing a single lf. at the summit: fls. in a nodding raceme from the axil of the lf.; sepals free or

the lateral ones united at the base; petals smaller; labellum free, similar to the petals or 3-lobed; column short, without lateral branches.—One of the largest of the genera of orchids containing about 400 species, dispersed in the region extending from Brazil and Bolivia to Mex. and the W. Indies.

Roëzlii, Reichb. f. Lvs. oblong-lanceolate, 4-10 in. long: fl.-st. often a little longer than the lvs.: fls. purple-brown, in a 1-sided raceme. Columbia. Gt. 50, p. 272.

ornata, Reichb. f. A very small caespitose plant with lvs. scarcely 1 in. long: fls. opening successively on erect, zigzag racemes a few inches long, inconspicuous, yellow with brown spots. B.M. 7094.—The plant is easily distinguished by the sepals, which are fringed with silvery pendulous hairs.

P. apiculata, Lindl. Lvs. 1-2 in. long, linear-lanceolate; racemes 3-5-fl., about as long as lvs.; fls. pale yellow, about $\frac{1}{4}$ in. long. Venezuela.—*P. attenuata*, Rolfe. Lvs. elliptic, 1-1 $\frac{1}{4}$ in. long; scapes slender, 2-4-fl.; fls. about $\frac{3}{8}$ in. long; sepals and petals light green marked with purple; lip greenish white.—*P. barbosana*, De Wild. Lvs. small, oblong-lanceolate: fls. small, yellow, rather nodding. Brazil.—*P. Birchenallii*, Rolfe. Fls. 3-7 in a raceme; sepals dull reddish purple, the dorsal green-margined at base, lanceolate, long-acuminate, nearly 2 in. long; petals long-acuminate, about $1\frac{1}{4}$ in. long, light green striped brown at base; lip 3-lobed, less than $\frac{1}{2}$ in. long, the erect side lobes greenish white, the front lobe dull reddish purple. Colombia. G.C. III. 45:391.—*P. Cogniauxiana*, Schlecht. Fls. densely hairy on outside, pale, densely covered with purple markings. Costa Rica.—*P. crinita*, Hort. Very small: lvs. orbicular: infl. bearing 4 fls., each about $\frac{1}{2}$ in. long, covered outside with long whitish hairs; dorsal sepal light green, with pale brown dots; lateral sepals united, red-purple. Brazil.—*P. cuneifolia*, Cogn. Lvs. very fleshy, lanceolate: fls. $1\frac{1}{4}$ in. long; lower half of sepals thin, pale yellow with red spots, upper half very fleshy, pale reddish brown. Brazil.—*P. dubia*, A. Rich. Small, creeping: fls. yellow, with shining orange-yellow lip. Mex.—*P. pectinata*, Lindl. Raceme distichous; fls. sea-green, with a few deep purple spots on base of lip; sepals pubescent, elongated, the dorsal linear; petals linear-lanceolate; lip clawed, oblong, toothed at base. Brazil. G.W. 14, p. 523; 15, p. 680.—*P. repens*, Ames. Lvs. $1\frac{1}{4}$ -2 in. long, elliptic-oblong; peduncles 1-fl.; fls. 3-3 $\frac{1}{4}$ in. long, reddish brown. S. Brazil.—*P. rubens*, Lindl. Raceme very long; sepals lanceolate, acuminate; petals obtuse; lip obovate, repand, obtuse. Brazil. G.W. 13, p. 367.—*P. subulifolia*, Kränzl. Lvs. nearly 2 in. long, subulate; racemes slightly longer than lvs., 5- or more-fl.; fls. about $\frac{1}{2}$ in. long, yellow, with purple lines. Brazil.—*P. venosa*, Rolfe. Lvs. $5\frac{1}{4}$ -8 in. long, lanceolate-oblong; racemes many-fl., 4-6 in. long; fls. very small, greenish. Trop. Amer.

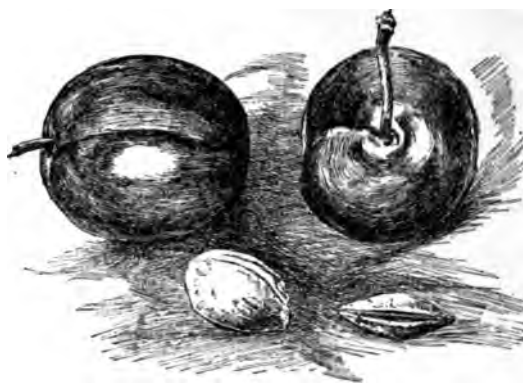
GEORGE V. NASH.†

PLOCAMA (Greek, *bent hairs*, alluding to the pendulous branches). *Rubiaceae*. Erect branched shrubs, usually fetid, to be grown under glass for the bloom or planted out far S.: branches very slender, pendulous: lvs. opposite or verticillate in 4's, linear-elongate, filiform, acute, flaccid; stipules connate into a short scarious sheath, persistent: fls. minute, axillary or terminal; calyx-tube globose, 5-lobed, persistent; corolla funnel-form-campanulate, short-tubed, pilose-throated, limb 5-7-lobed, lobes oblong-lanceolate with the tip bent and callous, valvate; stamens 5-7; ovary 2-3-celled: fr. a small globose, white, succulent berry. One species, Canary Is. *P. pendula*, Ait., the only species, grows about 2 ft. high, has white fls. and linear-oblong filiform lvs. Intro. in S. Calif. and also cult. in greenhouses abroad.

PLUKENETIA (from Leonh. Plukenet, an English botanist of the 17th century). *Euphorbiaceae*. Woody climbers, sometimes cult. in the tropics for the fr.: lvs. alternate, simple, often cordate, 3-5-nerved: fls. small, in lateral clusters, apetalous; calyx valvate; stamens 8-30; styles united to the apex into a swollen column; ovules 1 in each cell of the ovary. About 12 species in the tropics of both hemispheres. Related to *Dalechampia* and *Tragia*. The 4-lobed fr. of the following species is edible and has been utilized for hog-feed, for which they are frequently planted in their native land. *P. volubilis*, Linn. Style-column long and slender: lvs. cordate, somewhat pointed, repand or serrate on margin. W. Indies. *P. corniculata*, Smith. Style-column ovoid or hemispherical. Java; lvs. said to be aromatic and used as a pot-herb. J. B. S. NORTON.

PLUM. The tree and fruit of many species of *Prunus*. A few kinds are grown for the ornamental flowers and others for colored or variegated foliage. Prunes are cured dried plums.

It is probably more difficult to give specific practical advice for the management of the plum than for any other common fruit, for the reason that it represents



3068. Plum.—Peter Yellow Gage. ($\times \frac{1}{2}$)

several distinct species which are not equally adapted to all parts of the country, and the same remarks will not apply to them all. There is no country in which the domesticated plum flora is so complex as in North America, for not only are the specific types of Europe and of Japan grown, but also species that are peculiar to this continent. In the northeastern states and on the Pacific slope the European or domestica types are the leading plums. In these same areas and also in the South and in parts of the mid-continental region, the Japanese plums also are now popular. In the cold North, in the great interior basin, and also in many parts of the South, various native types now constitute the leading cultivated plums. These native plums are developed from wild species of the country, and they are unknown in cultivation (except in botanical or amateur collections) in any other part of the world. These have been developed chiefly within fifty and sixty years, although a few varieties are older than this. For a history of this evolution, see Bailey, "Sketch of the Evolution of our Native Fruits," also, as well as for culture and varieties of plums in general, Waugh, "Plums and Plum-Culture," and Hedrick, "The Plums of New York." See *Prunus*.

The plums cultivated in North America may be arranged in the following groups:

1. Domestica or European types, *Prunus domestica*. Native to western Asia, comprising the common or old-time plums, such as Green Gage, Lombard, Bradshaw, Yellow Egg, and the like. They are the leading plums from Lake Michigan eastward and north of the Ohio, and on the Pacific slope. Figs. 3068, 3069 are of this species. The Damsons (Fig. 3070) are small-fruited forms of this general species-type. Of late years, hardy races of *Prunus domestica* have been introduced from Russia. These have value for the colder parts of the plum-growing regions. Figs. 3071, 3072, show representative forms of the Russian type.

2. The Myrobalan or cherry-plum type, *Prunus cerasifera*. Native to southeastern Europe or southwestern Asia. The seedlings are much used for stocks upon which to bud plums; the species is also the parent of a few named varieties, as Golden Cherry; and DeCaradeuc and Marianna are either offshoots of it or hybrids between it and one of the native plums, probably hybrids.

3. Japanese types, *Prunus salicina* (*P. triflora*). Evidently native to China. The type seems to be gener-

ally adapted to the United States, and is of great value to both the South and North. This species first appeared in this country in 1870, having been introduced into California from Japan. For historical sketch, see Bulletin No. 62, Cornell Experiment Station (1894); also Bulletin No. 106 (1896); Hedrick, "The Plums of New York." Fig. 3073 shows one of these plums; also Fig. 3074, as to tree forms, which are very variable in the different pomological varieties.

4. The apricot or Simon plum, *Prunus Simonii*. Native to China. Widely disseminated in this country, but little grown except in parts of California. Introduced about 1881.

5. The americana types, *Prunus americana*, *P. nigra* (Figs. 3075, 3076), and *P. mexicana*. The common wild plum of the North, and extending westward to the Rocky Mountains and southward to the Gulf and Texas. Admirably adapted to climates too severe for the domestica plums, as the Plains and the upper Mississippi Valley.

6. The Wild Goose and Chickasaw types, *Prunus hortulana*, *P. angustifolia*, *P. Munsoniana* (Figs. 3076, 3077). A variable type of plums, comprising such kinds as Wild Goose, Wayland, Moreman, Miner, Golden Beauty, Newman, Caddo Chief, Lone Star, and many others. The species involved in this group are not yet clearly defined botanically, and what part the hybrid and intergradient forms play in the evolution of cultivated varieties is yet largely to be determined. In adaptability they range from Michigan to Texas, eastward and westward, but are essentially fruits of the great interior basin.

7. The Beach plum, *Prunus maritima*. Native to the coast from New Brunswick to Virginia. In cultivation, represented by the unimportant Bassett's American; also as an ornamental plant.

8. The Pacific Coast native plum, *Prunus subcordata*, wild in California and Oregon. Sparingly brought into cultivation, chiefly in the form known as the Sisson plum.

The welding of these many stocks will undoubtedly produce a wide range of fruits in the future, of which we yet see only the first promise. The experiments of Hansen in South Dakota in hybridizing *P. Simonii* and



3069. Plum.—Follenberg or Italian prune. ($\times \frac{1}{2}$)

P. americana, *P. salicina* and *P. americana*, *P. Besseyi* with plums, and others for a marginal climate, as well as the experiences of other workers in combining many of the species, all point to a wealth of plums for a continental area.

The plum of history is *Prunus domestica*. It is to this species that general pomological literature applies. It gives us the prunes (see *Prune*). These plums may

be thrown into five general groups, although any classification is arbitrary at certain points:

1. Prunes, characterized by sweet firm flesh, and capable of making a commercial dried product. They may be of any color, although blue-purple prunes are best known. Some of the prunes are grown in the East as ordinary market plums, being sold in the fresh state. Almost any plum can be made into dried prunes, but the varieties used commercially for this purpose constitute a more or less distinct class of sweet and thick-fleshed kinds (see definition, page 2719). In the East, prune is nothing more than a varietal name.

2. Damsons, comprising very small firm plums of various colors, usually borne in clusters, the leaves mostly small. The run-wild plums of old roadsides and farmyards are mostly of the general damson type (Fig. 3070).

3. The green gages, comprising various small green or yellow-green plums, of spherical form and mostly of high quality. Reine Claude is the commonest



3070. Damson plum. ($\times \frac{3}{4}$)

representative of this group in the East. The name green gage often stands for a group rather than for a variety.

4. Large yellow plums, such as Coe Golden Drop, Washington, and the like.

5. Large colored plums, including the various red, blue, and purple varieties, like the blue prunes, Lombard, Bradshaw, Quackenboss, and the like.

The Japanese plums (*Prunus salicina*) differ from the domesticas in having longer thinner smooth and mostly shining leaves, smooth twigs, a greater tendency to the production of lateral fruit-buds on the annual growth, and mostly rounder or shorter fruits with colors running more to cherry-reds and light yellows. Most of the varieties are as hardy as the domestica series. The Japanese varieties are important because they add variety to the list, and especially because they are rich in very early kinds, and the fruit is usually so firm that it carries well; aside from this, the trees are vigorous and very productive, and the species is less liable to injuries from black-knot and curculio than the domesticas.

The native plums, chiefly offspring of *Prunus americana*, *P. nigra*, *P. angustifolia*, *P. munsoniana*, and *P. hortulana* represent a wide range of varieties. Those from *Prunus americana* and *P. nigra* parentage are very hardy and are adapted to regions in which the domestica and Japanese types are tender, as in northern New England, parts of Canada, and the northern plains states. Those partaking strongly of *P. angustifolia* parentage, and the greater part of the hortulanas, thrive well in the South, where the climate is too con-

tinuously hot for other plums or where the fruit-rot fungus is too prevalent.

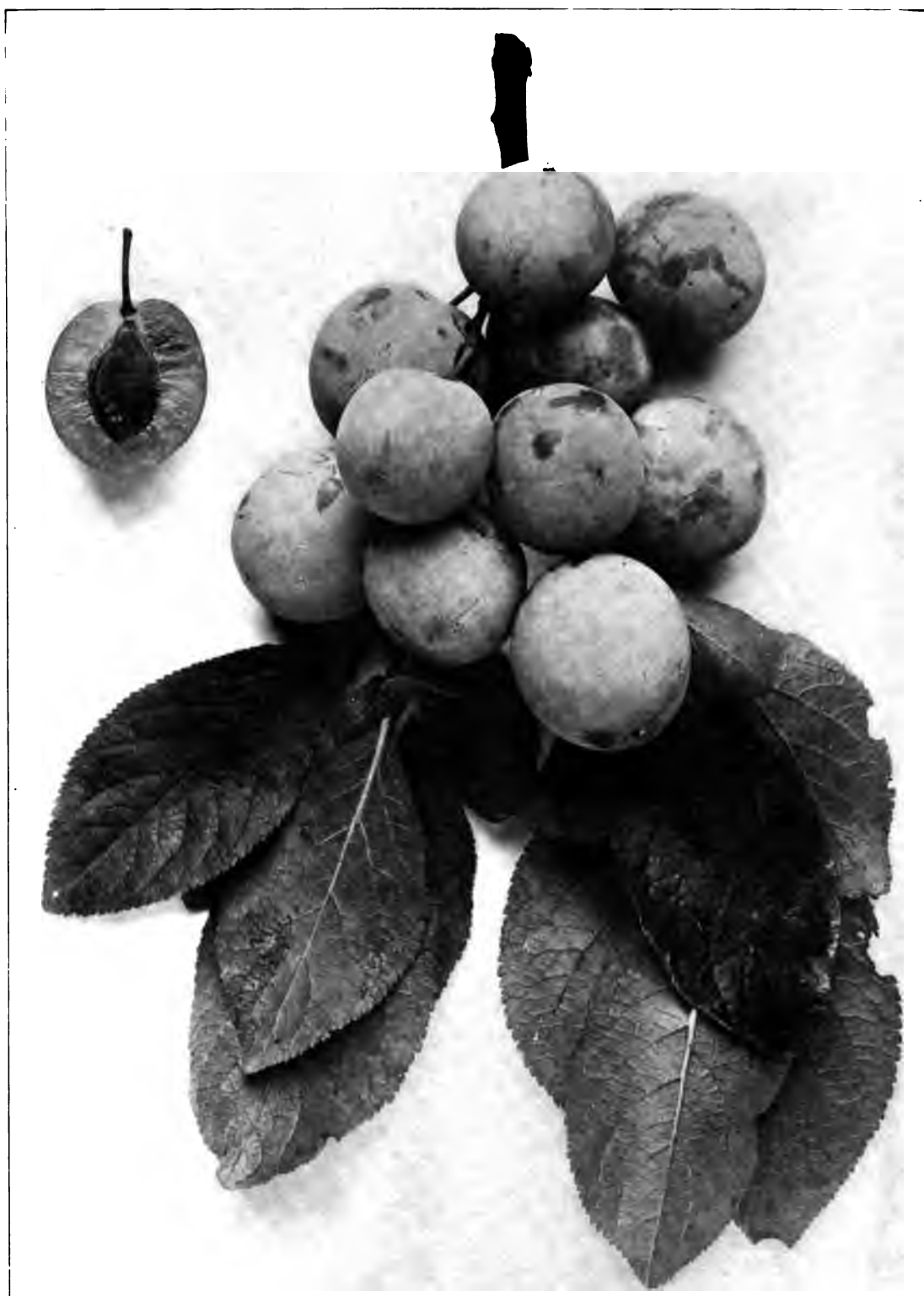
The domestica varieties are mostly fertile with themselves, but the natives usually bear best in mixed planting so that pollination is assured. See *Pollination*. The Japanese varieties also usually profit by mixed planting. How far failure to set fruit is due in general to lack of pollination and how far to other causes, is yet largely to be worked out.

Plum-growing.

The plum thrives on a variety of soils. The domesticas commonly do best when planted in clay loam. They usually thrive well on lands which are suited to pears, or on the heavier lands to which apples are adapted. Yet many varieties grow well on lands that are comparatively light or even almost sandy, with good care. The americans thrive best in a rather moist soil, and mulching is often very favorable to the size and quality of the fruit.

The stocks upon which plums are grown are various. By far the greater number of the trees in the North are now grown on Myrobalan, which is a species of rather slow-growing plum (*Prunus cerasifera*), native to southeastern Europe and southwestern Asia. This is the stock sometimes recommended in the older fruit-books for the making of dwarf trees; but unless the top is kept well headed in, the trees generally make normal growth upon it. Trees grown on this root are usually larger and finer at one or two years of age than those grown on other plum stocks, and the probability is that they are nearly as useful from the grower's standpoint as any other. However, there are some varieties that overgrow the Myrobalan, and the stock is likely to sprout from the ground and thereby cause trouble. The Myrobalan is variable from seed, and this fact may account for some of the unsatisfactory results now and then reported. St. Julien is perhaps a better stock, but is more expensive to import and less readily budded. The Myrobalan and St. Julien stocks are imported.

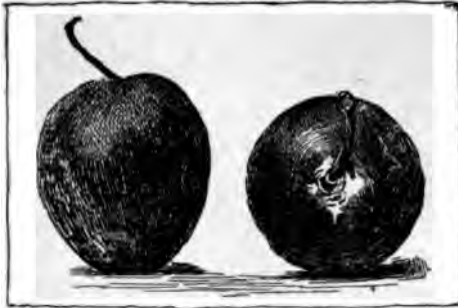
Probably the best stock for domesticas, from the standpoint of the grower, is the domestica itself, but seeds of it are more difficult to secure, the stock is more variable and it is more likely to be injured in the nursery row by leaf-fungi; therefore, as a matter of practice, the Myrobalan has very generally supplanted it. In the middle and southern states the peach is largely used as a stock upon which to grow plums, and it seems to be gaining favor in the North. It is undoubtedly a very excellent stock for sandy lands, and, in fact, is probably better for such lands than the Myrobalan itself. Some varieties—of which Lombard and French Damson are examples—do not take well on the peach. The Japanese plums are commonly worked on the peach. The Marianna stock, which is much recommended in the South, has not found favor in the North. Some varieties of plums are such slow and crooked growers in the nursery that it is advisable to top-graft or bud them on some strong and straight stock. The Lombard is no doubt the most adaptable stock for this purpose now grown by nurserymen. The old Union Purple is one of the best stocks, but is not much grown at present. Reine Claude, German Prune, and Copper are probably best when top-worked on some strong stock. For many native varieties, seedlings of vigorous natives, as of Golden Beauty and Wayland, make excellent stocks. Americans should be worked on their own seedlings, at least in the North. In the South they are often budded on Marianna. The whole subject of plum stocks needs experimental study.



XC. Bavay or Reine Claude (Reine Claude de Bavay), one of the Green Gage plums of American orchards.



Plum trees are usually planted when two years old from the bud, although some of the strong-growing kinds may be planted at a year old with the very best results. As a rule, all plum trees are planted about as far apart as are peaches, that is, from 15 to 20 feet each way. Many growers prefer to plant them closer one way than the other and eventually to stop cultivation in one direction. If this system is used, they



3071. Early Red, one of the Russian plums. ($\times \frac{3}{4}$)

may be placed 18 or 20 feet apart one way, and 8 to 12 feet the other way. When planted, the trees are pruned in essentially the same way as apple trees. It is usually advisable to start tops as low as possible and yet allow of the working of the curculio-catcher or other tools below them. This means that the limbs should start from 3 to 4 feet above the ground. With the modern implements and methods of tillage, there is little inconvenience in working the land if tops are started as low as this. The subsequent pruning of the plum tree has no special difficulties. About four or five main limbs are allowed to form the framework of the top, and in most varieties, especially those which are not very tall growers, the central trunk or leader may be allowed to remain. The fruit of the domestica is borne mostly on spurs, as shown in Fig. 3078. These spurs, therefore, should not be removed unless it is desired to thin the fruit. In the americana and the Japanese varieties, the fruit is borne both on spurs and on the annual axial growth.

Insects and diseases.—The black-knot is one of the most serious plum diseases. It is best kept in check by systematically cutting it out (several inches below the swelling) and burning it. The grower should go over his orchard for it in the summer and again as soon as the leaves fall. If trees are thoroughly sprayed every year with self-boiled lime-sulfur or bordeaux mixture for the leaf-blight fungus, the black-knot will make comparatively little headway in the orchard.

The blight, which causes the leaves to fall in August or September, is a damaging disease; but it can readily be kept in check by thorough spraying with self-boiled lime-sulfur or bordeaux mixture two or three times during the summer. The mixture for spraying plums should be weaker than for apples, particularly for the Japanese varieties.

The fruit-rot is the work of a fungus. Many times the dead and dried fruit may be seen hanging on the tree all winter, as shown in Fig. 3079; and in such cases it is very likely that the fruit-spur may be killed, as the upper one in the picture has been. In handling this disease, the first consideration is the fact that some varieties are much more susceptible to it than others. The Lombard is one of the worst. Again, if the fruit grows in dense clusters, the disease is more likely to be severe. The thinning of the fruit, therefore, is one of the best preventives of the spread of the disease, and at the same time, also, one of the most efficient means of increasing the size, quality, and salableness of the product. Thorough spraying with self-boiled lime-sulfur

is a specific for the trouble and helpful in related troubles or diseases.

The curculio, which causes wormy fruit, can be held in check by the process described under Peach. Formerly, jarring the beetles on sheets or curculio-catchers (a wheelbarrow-like device with a large cloth hopper) was the prevailing practice with those who gave extra care to their fruit, and this method is still recommendable to amateurs and small plantations; but with the modern good tillage and the practice of keeping all parts of the plantation and the hedge-rows clean, and with the introduction of more effective spraying, the curculio is found to do much less damage and usually to be held sufficiently in check. Practising open pruning to let in the sun, and raking the dropped fruit out into the sun will also check the breeding. How far spraying with arsenicals will control the curculio on plums is not yet well understood, but growers usually feel that it is a distinct aid. To the bordeaux mixture or to self-boiled lime-sulfur, two and one-half pounds of arsenate of lead may be used to the fifty gallons, in one spraying soon after the petals drop, and another a week or ten days later.

L. H. B.

Native American plums.

Approximately 300 varieties of plums, derived chiefly from six native types, have been named, described, and introduced by American nurserymen and have found their way into American orchards and American pomological literature. The major part of this interesting development came in response to the urgent demand, most manifest in the years from 1870 to 1900, for the discovery of new types of garden fruits suited to the peculiar conditions of the middle western prairie states. Outside this area, the native American plums made much less impression, and while they have been widely tried, they have been generally discarded. Even in the area to which they are native and in which the need for them is greatest, they do not now play an exclusive rôle. A large part of the named varieties introduced by the nurserymen have already been lost to American horticulture. A creditable minority of these varieties, however, have qualities of absolute and considerable merit, and may be looked on as permanent additions to our pomological wealth. The native varieties are still propagated and planted by thousands annually, both for home use and for market. For certain culinary purposes, many of the natives are superior; and in many places, particularly in states of middle latitude, they are the most profitable market plums grown.

The americana plums are especially qualified to withstand the severity of northern winters. They are superlatively hardy. They are practically the only plums



3072. Voronesh Yellow, a Russian plum of somewhat recent introduction. ($\times \frac{3}{4}$)

grown in the cold northwestern states (except the comparatively unimportant *nigras* and the *Miners*) and their usefulness in northern New England and middle Canada is limited only by the extent to which they are known. Their cultivation has been developed to a special degree in Iowa, Wisconsin, Minnesota, and adjacent states. For this region they must be propagated always on americana stock. This stock has other advantages besides its hardiness, and it is coming into extensive use for all sorts of plums in the Northwest. The sand cherry is sometimes used as a stock, but has not yet passed the experimental stage. It dwarfs americana plums worked on it. It is perfectly hardy.

The americana plums are wayward and awkward growers. With many varieties it is impossible to make a comely orchard tree. They do not appear to take kindly to pruning; and the usual method has been to let them very much alone. Careful pruning during the first few years, directed with a view to forming an open top on comparatively few supporting main branches, will do something toward shaping the trees; but with our present knowledge, no extensive pruning can be recommended for mature trees. The method of heading-in, as often practised with the domestica plums, is especially unadapted to the americanas.

The americana plums are early and very prolific bearers. Overbearing is a habit and a serious fault with most varieties. Extensive thinning of the fruit is indispensable. The trees are sometimes severely attacked by shot-hole fungus, and thorough spraying with bordeaux mixture or lime-sulfur is necessary. The fruit-rot (*sclerotinia*) attacks all the native plums more or less, and must be controlled by the usual remedies. See *Diseases and Insects*, Vol. II.

The *nigra* group has two or three important varieties of superior hardiness, as *Cheney* and *Aitkin*. In general, they bloom earlier and fruit less heavily than the americanas. Their habits and culture are the same.

The *Miner*-like varieties are hardly to be distinguished from the americanas in any way. They have practically the same geographical range, and may be given the same treatment in the orchard.

The *hortulana* group includes several varieties of great value, especially for the South. Of these, *Wayland*, *Golden Beauty*, *Moreman*, *Benson*, and *Kanawha* may be mentioned. They are not to be recommended generally for localities north of Massachusetts and Nebraska, their northern limit being determined less by their non-hardiness than by the very late ripening. This habit of late ripening, combined with very late blooming, makes them desirable for late marketing, particularly in southern markets. They are very prolific and constant bearers. The trees are free-growing, usually of rather spreading habit, and will bear heading-back better than the americanas. The pruning-knife, if used in season and with good judgment, will assist in making comparatively open-headed trees of these varieties.

The *Wild Goose* group (*P. Munsoniana*) includes varieties like *Wild Goose*, *Milton*, *Wooton*, and *Whitaker*, specially adapted to the latitude of Maryland, Kentucky, and Kansas. They succeed only less well southward; but are not generally valuable to the north of this line. For the section named, the varieties of this class have unquestionably been the most profitable

plums grown up to the present time. They are propagated chiefly on peach, *Marianna*, and *Myrobalan*, but succeed even better on americana stocks. These stocks are all fairly satisfactory, though not equally good for all varieties; but, when peach stocks are used, the union should be made by whip-grafting on the peach root. Otherwise the peach stock comes above the ground and is a prey to the peach borer. The trees are mostly rapid willowy rather zigzag growers; and are amenable to the pruning-knife in about the same degree as the *Wayland*-like varieties already mentioned. *Whitaker* makes an open-headed tree without much trouble. So does *Sophie*. *Wild Goose* is more inclined to be thick and thorny in the top, but may be thinned carefully to make an accessible head. *Milton* is much like *Wild Goose*. *Wooton* makes a fine vase-form top, which, with a little timely pruning, is almost ideal. *Wilder*, *James Vick*, and some others, are prone to make thick bushy thorny tops, and are hard to manage. These varieties are all considerably subject to shot-hole fungus, which often strips them of their foliage in mid-summer. They are mostly thin-skinned and liable to crack at ripening times, especially if the weather is wet. They should be picked rather green for shipment, the point to be observed being that they have attained their full size, rather than that they are dead ripe.

The *Chickasaw* varieties (*P. angustifolia*) are effective pollinizers for the *Wild Goose* and *Japanese* varieties blooming at same time; but very few of them have sufficient value in themselves to make them profitable orchard trees. A few varieties, like *Munson* and *McCartney*, are still planted for their own fruit; but in general they have been displaced by other types of plums. The trees are mostly bushy, thorny and thick-topped, sometimes so thick and thorny that the black-birds can hardly get in to steal the fruit. It is difficult

to prune them enough to make really satisfactory trees. The *Chickasaw* plums are specially adapted to the southern states, though *Pottawatamie* (probably a form of *Prunus Munsoniana*) succeeds as far north as southern Iowa and central Vermont. They propagate readily on any kind of stocks, but are very much given to suckering wherever they make roots of their own.

Other types of native plums, such as the *Sand plum*, the *Beach plum*, the *Pacific plum*, and the like, are not sufficiently

numerous in cultivation for their treatment to have been determined.

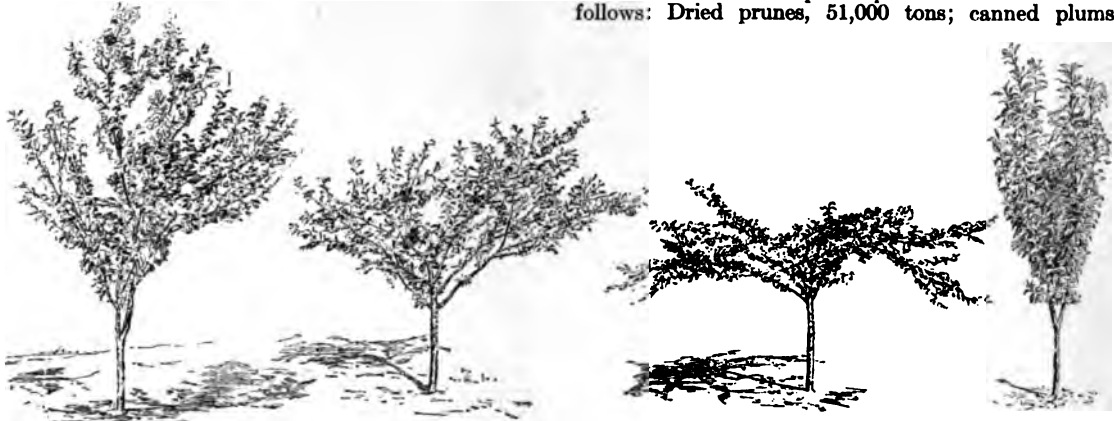
Hybrid plums of various strains have been introduced in considerable numbers. Most of these hybrid varieties resemble rather strongly one or the other of their parent species; and the best that can be said regarding their culture at this early day is that they may be safely treated like the varieties which they most closely resemble. *Wickson*, *President*, and perhaps *Climax*, with some others, resemble the *Simon plum*, and ought to have much the same treatment, that is, practically the same treatment as the *Japanese* varieties. *Gonzales*, *Excelsior*, *Golden*, and *Juicy*, on the other hand, resemble the *Wild Goose* type, and may have the same general treatment as *Wild Goose*. Some of these hybrid varieties, especially crosses of *Wild Goose* and *Chickasaw* types with the *Japanese* plums, are making some stand commercially, especially in the South, West, and in the Rocky Mountain States.



3073. The Japanese type (*Prunus salicina*).—*Maru*; once grown. (× 1/4)

All the native plums, with wholly negligible exceptions, require cross-pollination. For the most part, however, they are fully inter-fertile, so that one given variety will pollinate any other variety, providing the two bloom at the same time. Simultaneous blooming is of chief importance in adjusting varieties to one another for cross-pollination. To determine which varieties bloom together, careful observations should be made in

fermentation around the pit in the process of drying, which prevents their being successfully dried without its removal; these are known as "plums." The prune varieties are, however, much richer in sugar which determines their adaptability to drying whole. As California has to find distant markets for most of its immense fruit crops, by far the greater portion of the plum areas are devoted to the production of prunes. The total amounts of plums produced in 1914 are as follows: Dried prunes, 51,000 tons; canned plums,



3074. Forms of tree of Japanese plums, at early bearing age.—Left to right: Abundance, Georgeson, Burbank, Wickson. The Wickson is probably a hybrid with *P. Simonii*.

the orchard and recorded, or recourse must be had to the published tables. Pollination is effected chiefly, if not exclusively, by the bees, so that their presence should be encouraged.

Most of the native plums make comparatively small trees, so that they may be set somewhat close together in orchard planting, say 12 to 20 feet apart, usually about 15 feet. Some varieties, particularly in the South, need 20 to 30 feet space. Putting a plum orchard down to grass is not admissible under any circumstances; but cultivation should cease with the first of July, or certainly by the middle of July; for the native plums are especially liable to make too much late summer growth. High manuring of the soil is not usually necessary, or even desirable; yet something considerably short of starvation will be found the best treatment for native plums.

F. A. WAUGH.

The plum in California.

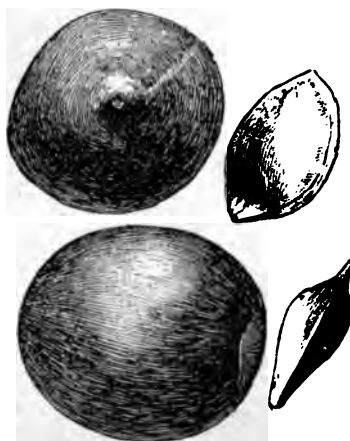
The cultivation of the plum in California differs widely from that in the other plum-producing sections of the United States. Here the dreaded curculio is unknown, and while the equally dangerous black-knot has been found infesting a native wild cherry (*P. demissa*) it has never been observed in cultivated orchards. The most delicate varieties of the Old World find a very congenial home and form the basis of practically all orchard planting. In early mining days the California native plum (*Prunus subcordata*) was frequently cultivated, and before the introduction of European standard varieties attempts were made to improve the fruit by the usual methods of selection. Some very promising results were obtained; but since the demonstration of the great success of the more delicate and higher-flavored varieties, there has been little incentive to the use of the native species.

It seems hardly fair to make a distinction between "plums" and "prunes" in discussing this subject from the California standpoint. With the exception of the differences in the preparation for market, what may be said of the plum applies as well to the prune; for a prune is simply a plum which dries sweet without removing the pit. In most of the varieties of plums there occurs a

90,000 cases or 2,160,000 quarts; overland shipments, 7,906 carloads of fresh fruit.

The plum has an exceedingly wide range in California. It is thrifty and healthy on the immediate coast, in the interior and coast valleys, and well up into the foothills. This is perhaps most strikingly shown by the fact that every county in the state, except two perhaps (one being the city of San Francisco), contains plum or prune orchards, or both. When it is considered that this covers an area of nearly 160,000 square miles, extending through $9\frac{1}{2}$ degrees of latitude, a fair estimate of the adaptability of this fruit to varying conditions of soil and climate will be obtained. By choosing varieties ripening in succession, the California plum season may be extended from May to December. It is not surprising, then, that the acreage devoted to plums and prunes is one of the largest in the state, reaching a total of nearly 142,000 acres, an aggregate of nearly 11,000,000 trees, of which about four-fifths are prunes. Placer County leads in the acreage of plums with

5,500 acres, and Santa Clara in prunes with 58,400 acres. This great industry has developed since the discovery of gold. The early Mission plantings (1769–1823) included varieties of European plums, a few of which were able to survive after the abandonment of the Missions in 1834, by reproducing themselves by suckers. One variety found at Mission Santa Clara was grown and marketed as the "Mission prune" as late as 1870. The



3075. The americana type of plum.—Weaver (*Prunus americana*). (×1)

introduction of improved plum varieties, however, dates back to 1851, when the first grafted fruit-trees were brought to the state by Seth Lewelling from Oregon, where he and his brother had established nurseries in 1847. Prior to this introduction, however, the miners were supplied with fruit of the native plums. The first importation of prune cions from France by the United

States Patent Office in 1854 did not reach California. It was not until two years later that Pierre Pellier brought with him to San Francisco a small package of cions from the famous prune district of Agen, in France, which arrived in fairly good condition and were at once sent to Pellier's brother, Louis, who had already established a nursery and fruit-garden in the Santa Clara Valley, upon a portion of the site of the present city of San José. From these cuttings, a number of trees were produced which succeeded admirably, and eventually were distributed through different sections of the state, but principally in the Santa Clara Valley, which to this day remains the center of the California prune industry. In 1863, the first California-grown and -cured prunes were exhibited at the State Fair in Sacramento; but it was not until 1870 that planting on a commercial scale was begun. Through the seventies, and especially after 1878, numerous orchards were set out, until in 1881 some of the

3076. Flowers of native plums. *Prunus americana* on the left; *P. Munsoniana* on the right.

larger growers were producing between five and six tons of cured fruit. Since 1881 the growth of the prune industry has been marvelous, until now there are growers whose annual products reach hundreds of tons.

Considerable difficulty was at first encountered in the selection of the proper grafting stocks. The native species, first used to some extent, were soon found to be unsatisfactory, on account of suckering, and dwarfing effect. Peach, apricot, and almond roots were used, the peach and almond proving best. The introduction of the Myrobalan or French cherry-plum (*Prunus cerasifera*) and its adoption as a grafting stock for plums and prunes have greatly simplified matters. It does not sucker, and experience has shown that in California it succeeds in low moist lands, in comparatively dry soils, if not too loose, and in stiff upland clay soils. It thus has become the all-round plum stock in California. On deep mellow loam soils, specially adapted to the peach, that root is still preferred for plum stock; but many varieties, e.g., the Columbia, Yellow Egg, and the Washington, do not unite well with it, and cannot, therefore, be worked directly upon it. The almond is widely used in loose, warm, or rocky foothill soils, and the deep light valley loams for the French and Fellenberg prunes. The Myrobalan seedling, then, is used almost entirely, except in special cases, as an all-satisfactory grafting stock for the plum in California. Propagating the Myrobalan stock from cuttings

has been practically abandoned, and seedlings are now the rule. This is all-important in California, for there the roots of all plants must necessarily go deep for their moisture and nourishment. In fact, deep-rooting is the rule beyond all common expectation; thus almond roots the thickness of one's thumb have been found at a depth of 22 feet—one of the many instances of the characteristic conditions of California agricultural practice.

Propagation is by both buds and grafts. The usual practice is to bud the young stock in July and August, and then, in January and February following, all those which have not taken can be grafted, thus securing two chances. When peach or almond is used as stock, budding alone is done, as these stocks have been found to take the graft poorly. The trees are not allowed to remain in nursery longer than one year after budding, and in many cases are set out the spring following, as "dormant buds." In early days the tendency was to rather close planting, in some cases as close as 16 feet; but later plantings were made with wider distances, until from 20 to 24 feet has come to be the rule. The laying out of orchards has caused much discussion, some asserting that the quincunx, hexagonal, and triangular systems secure better use of the land and allow better access to plow and cultivator than do the plantings in squares. The square system, however, has come to be most generally used. The style of tree is the low-headed vase-form. The rule is to cut back the young trees at planting to 18 to 24 inches. Until the top is formed the stems are protected, by whitewashing or wrapping with burlap, from the hot afternoon sun. The first year from three to five branches are allowed to grow from the stem, and these used to form the main limbs of the tree. From this time the pruning is done according to the usual methods for the vase-form tree. Many plums, owing to the brittleness of the wood, are yearly pruned rather short but the French prune is able to carry fruit on much longer branches. After the third or fourth season, the growth of wood is much less and usually the pruning operations are confined to keeping the tree in shape, removal of dead or damaged branches, and shortening-in the current season's growth to keep the young twigs in a vigorous growing condition and to prevent overbearing. The long slender branches are not cut back. The long arching

"canes" are allowed to remain until they have produced a crop (which they do in the second season with the greatest profusion), the ends resting upon the ground as the fruit gains weight. When these droop too low, they are cut back to the crown, when others will be produced to take their places.

Thorough and persistent tillage is one of the first principles of the California orchardist, for with him the absence of summer rains makes the conservation of the winter rainfall an absolute necessity. Even in the summer-irrigated districts the soil is tilled and kept loose as soon as it is in proper condition, and no weeds allowed to rob the trees. Formerly all the prune and plum crop was produced without summer irrigation. Winter irrigation was often practised and the water conserved in the soil by the usual methods of tillage. But regular bearing of fruit of good size requires adequate moisture. The installation of pumping plants



3077. Wild Goose plum tree.

and irrigation systems, therefore, has received a great impetus, and the use of summer irrigation when required is an established practice.

In some of the older orchards, the need of fertilising is beginning to be felt. In a great many, the main deficiency has been found to be vegetable matter, and, consequently, nitrogen. The extremely fine tilth which has been maintained has resulted in the destruction of all natural green growth and the "burning out" of the humus, and has necessitated the call for a green-manure crop. This problem is rendered more difficult in California by the fact that any such crop must be produced during the winter months and be ready to plow-in with the beginning of tillage in March; for no summer-growing crop can be allowed in the orchard, unless the land is regularly irrigated and then alfalfa may be grown. On non-irrigated orchards, winter-growth of hardy legumes, as vetches, is undertaken.

As mentioned above, the plum has few serious enemies in California, and none which cannot be held in check by spraying and other treatment. Upon the leaves the plum aphid and the canker-worm have given some trouble. The "peach-moth" has been found at work on the prune trees, but not to any serious extent. The trees are subject to the attacks of the black scale (*Saissetia oleæ*), apricot scale (*Lecanium corni*), frosted scale (*L. pruinosum*) and pernicious scale (*Aspidiotus perniciosus*) being the most frequent; all of which, however, the California fruit-grower has learned to keep in check. The crown root-knot has also caused considerable trouble. Relief has been secured by cutting off the knots and painting the wounds with bordeaux mixture. In one district the peach root-borer has established itself and requires regular treatment. Thrips have also done some injury to blossoms and young fruit.

In California some fruit is usually borne the third year; in the fourth a fairly profitable crop is expected; the fifth, from 50 to 60 pounds to a tree should be produced, which ought to double in the sixth, and after that from 150 to 300 pounds is the rule. These figures apply mostly to the prunes. From 200 to 300 pounds are considered the average at full bearing in the Santa Clara Valley. In some instances 600 and even 800 pounds have been produced, and a six-year-old tree at Visalia (San Joaquin Valley) is credited with 1,102 pounds of fruit in one season.

It would be impossible to enumerate a full list of the varieties actually in successful cultivation within the state. Such a list would probably include every noteworthy variety of domestica plum. Many, however, despite excellence of quality and flavor, are suited only for home-growing, or at most for local markets, on account of poor shipping qualities. For this reason the number of varieties planted on a large scale is being constantly reduced. At the head of the list stands the Prune d'Agen,



3078. Fruit-spurs of a domestica plum. The letters indicate the termination of annual growths.

the originally introduced French prune, which has proved itself adapted to more varying conditions than any other variety, and is therefore perhaps the most generally planted variety of fruit in the state. It is, of course, used chiefly for curing. In the same category belong the Robe de Sergeant, Imperial Epineuse, Silver, and Sugar—all drying varieties. The Robe de Sergeant (supposed to be a synonym of the Prune d'Agen in France) in California is grown as a distinct variety. The fruit is larger, usually more highly flavored, and has commanded higher prices in the San Francisco market. The tree, however, has not proved so widely adaptable, and is in disfavor on account of defective bearing. The Silver prune (an Oregon seedling of Coe Golden Drop) is also a defective bearer in some districts, and is used mostly in the preparation of "bleached prunes," for which it has proved very profitable in some instances. It is sometimes marketed in the fresh state also. The Imperial Epineuse, a recently introduced French variety was largely planted but proved rather irregular in bearing, difficult to cure and very subject to thrip injury. Luther Burbank's Sugar prune bases its claims upon superior earliness, sweetness and flavor, together with fair medium size. It dries easily but is of coarse texture. The German prune, Italian (Fellenberg), Golden prune, Hungarian (Pond Seedling) and Tragedy are varieties sometimes used for curing, but are frequently shipped green as "plums." Of these the German is perhaps the most extensively used. The Italian succeeds well along the coast in places liable to fogs or sea winds, where the French is not at its best. It is valuable as a late variety, and is said to dry excellently, as does also the Golden, an Oregon seedling. The fruit of the Hungarian (Pond) is very handsome and showy, and is rated, on its style, a good seller as fresh fruit in both the local and distant markets, but is not suitable for drying. The Tragedy and the Clyman (California seedlings), Giant (Burbank's), Royal Hative, Simon, and Peach, are popular for early market—especially for eastern shipment. For canning, Coe Golden Drop and the Imperial Gage are the most popular. The Jefferson, Washington, and Yellow Egg are all highly regarded, and planted more or less widely, as they suit the different climatic regions. Many of the Japanese plums are grown. Red June, Satsuma, Burbank, Wickson, Climax, Santa Rosa, and Formosa (all Burbank varieties) are prominent for eastern shipment, local market and domestic use.

See Wickson's "California Fruits and How to Grow Them," the Reports of the California State Board of Horticulture, and the Reports and Bulletins of the California Experiment Station.

ARNOLD V. STUBENRAUCH.
E. J. WICKSON.†

PLUM, CHERRY: *Prunus cerasifera*. P., Cocca: *Chryso-balanus Icaco*. P., Date: *Diospyros*. P., Governor's: *Flacourtia Ramontchi*. P., Japan: Properly *Prunus salicina*; improperly applied to the loquat, *Eriobotrya japonica*. P., Marmalade: *Lucuma mammosa*.

PLUMBAGO (from Latin for *lead*, from the lead-colored flowers of some species, or because of some old tradition). *Plumbaginaceæ*. LEADWORT. Subshrubs or herbs, often cultivated, particularly under glass, for the handsome phlox-like flowers.

Mostly perennial, sometimes climbing, often more or less woody; lvs. usually alternate and entire, clasping (or auricled) by the blade or by base of petiole; fls.



3079. Plum-rot. The mummy plums hang on the tree all winter.

spicate or racemose on the ends of the branches, blue, violet, red, or white, gamopetalous, salverform, the tube usually slender; calyx tubular, 5-toothed, and somewhat angled, glandular; stamens usually 5, free from the corolla-tube, the filaments mostly with a dilated base; ovary attenuated at the top, the single style with



3080. *Plumbago capensis*.
($\times \frac{1}{2}$)

5 stigmas: fr. a membranaceous 5-valved caps.—About 10 or a dozen species inhabiting warm countries, chiefly of Eu., Asia, and Afr. For *P. Lar-pentæ*, consult *Ceratostigma*.

Two species of shrubby plumbagos, *P. capensis* and *P. rosea*, are deservedly well known. In the middle and northern states they are treated as greenhouse pot-plants and are usually turned out to flower in summer. They are readily prop. by cuttings taken either in autumn from plants growing in the open or in the spring from stock plants. They require an intermediate temperature.

AA. Fls. red.

rosea, Linn. (*P. sanguinea*, Hort.). St. zigzag, more or less climbing, glabrous even in the infl.: lvs. large, ovate-elliptic, the short petiole somewhat

clasping; fls. purplish red, in long racemes, the corolla-lobes little if any exceeding the exerted part of the tube, the calyx glandular-hairy; base of style hairy. S. Asia. B.M. 230. Var. *coccinea*, Hook. (*P. coccinea*, Salisb.), is a form with larger scarlet fls. B.M. 5363. Gng. 1:183. H.T. II. 6:292. This is the form chiefly cult.—Like *P. capensis*, this species is useful for summer bedding. It is also an excellent subject for winter blooming in pots.

AA. Fls. blue or white.

B. Perennials, with more or less scandent sts.

capensis, Thunb. Fig. 3080. Semi-climbing shrub but a straggling upright plant as grown under glass, somewhat glaucous, glabrous except in the infl.: lvs. scattered, oblong-ovate to oblong-spatulate, nearly or quite obtuse and short-mucronate, narrowed into a very short petiole; racemes relatively short, the fls. sometimes appearing as if umbelled; fls. azure-blue, with a very slender tube $1\frac{1}{2}$ in. long and several times longer than the glandular-hairy cylindrical calyx-tube, the corolla-lobes obovate and phlox-like; caps. oblong-clavate, tapering and angled below. S. Afr. B.M. 2110. B.R. 417. Gn. 44, p. 380; 46, p. 245; 48, p. 344; 58, p. 20. G. 18:519; 27:41. Gn.W. 24:121. G.W. 10, p. 331. R.H. 1908:60. Var. *alba*, Hort., has white fls.—A well-known greenhouse plant. Old plants turned into the soil in late spring in a sunny exposure bloom profusely until frost. Plants struck from fall cuttings also give good bloom the following summer, but younger plants usually do not bloom so well. Plants can be kept in a cellar during winter, or they may be grown under glass for spring and summer bloom. It is an excellent rafter plant. In S. Calif. it climbs trees 15–20 ft. high if undisturbed. *P. capensis* and the white-fl. varieties are the commonest kinds.

zeylanica, Linn. Half-climbing, much branched, glabrous except the infl., which is glandular-hairy: lvs. ovate or oblong, obtuse or acute, the base of the short-winged petiole clasping the st.: fls. white, shorter than in *P. capensis*, the exerted part of the tube scarcely longer than the obovate retuse corolla-lobes, the calyx glandular-hairy: caps. long-oblong, 5-grooved above. Tropics of Asia and Afr., and east to Austral. and Hawaii. B.R. 32:23.—Little grown now, as it is inferior to the white-fl. form of *P. capensis*. Distinguished from that species by its shorter fls. and different lvs.

scandens, Linn. Somewhat woody, trailing or climbing, much branched, glabrous, the branches grooved: corolla white with mucronate lobes, the tube twice longer than the glandular-hairy calyx-tube; stamens 4, exerted: lvs. ovate-lanceolate to oblong-lanceolate, pointed, stalked. Trop. Amer., and also in southernmost parts of U. S.

BB. Annual, with erect sts.

caerulea, HBK. Erect annual, 1–1½ ft. tall, with branched terete sts.: lvs. more or less rhomboidal, tapering to a winged and auricled petiole, glabrous and entire, the upper ones smaller: fls. small but rich in color, few and separate in a terminal spike, the tube purple and twice longer than the calyx, the segms. oval and acute, deep bluish purple with dark line in center; filaments not dilated. Peru. B.M. 2917 (as *P. rhomboidea*).

L. H. B.

PLUMERIA (Charles Plumier, 1646–1706, distinguished French botanist). Also spelled *Plumiera* and *Plumieria*. *Apocynaceæ*. Tropical trees grown for their showy and very fragrant flowers.

Leaves alternate, penninerved, the primary veins joined to a nerve running parallel with the margin: fls. in terminal 2–3-chotomous cymes: bracts usually large and covering the young buds but deciduous long before anthesis; corolla-tube cylindrical throughout; stamens included, near the base of the tube; disk wanting or fleshy and covering the tube of the calyx; ovules in many series: follicles 2.—About 50 species, all Trop. American, of which 2 kinds at present are offered in S. Calif. and 2 in S. Fla. The species are much confused and imperfectly understood.

Plumerias are amongst the most fragrant of tropical flowers, vying in this respect with the jessamine, Cape jasmine, and tuberose. They have large waxy funnel-shaped flowers with 5 spreading lobes of white, yellow, rose-purple, or combinations of the three colors. Choice specimens have been known to bear clusters 9 inches across, composed of more than twenty flowers each $3\frac{1}{2}$ inches across. They are considerably cultivated in all tropical lands. In the Pacific islands, *P. acutifolia* is frequent in graveyards. The word *frangipani* is supposed to be from the French, *franchipanier*, coagulated milk, referring to the tenacious white juice which exudes plentifully from the wounded plant. Other accounts suppose it to have come from an Italian nobleman of that name who in the Middle Ages compounded a perfume of many ingredients and which the odor of these flowers resembled. All species are likely to be called *frangipani*. Plumerias are essentially summer-growing plants. Keep rather dry in



3081. *Plumeria acutifolia*.

winter. Propagation is by cuttings in February or March.

A. *Fls. more or less rosy.*

rūbra, Linn. FRANGIPANI. Low tree or shrub: lvs. 5-8 in. long; cyne spreading; corolla-lobes broadly oval, longer than the tube. Mex. to Guiana and Ecuador; naturalized in W. Indies. B.R. 780 (fls. chiefly golden, only the tips bright rose). B.M. 279.—In W. Indies sometimes called "West Indian red jasmine."

AA. *Fls. chiefly white or yellow.*

B. *Lvs. narrow, oblong-linear.*

alba, Linn. Lvs. rounded or acuminate at top, revolute at margin, tomentose beneath; veins rectangular-transverse: fls. white. W. Indies.—*P. hypoleuca*, Gasp., is probably a color variety, with yellow fls.

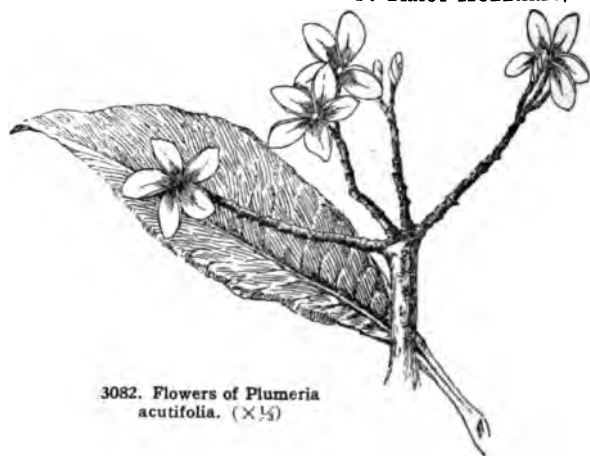
BB. *Lvs. wedge-shaped to lanceolate.*

acutifolia, Poir. (*P. acuminata*, Ait.). FRANGIPANI. Figs. 3081, 3082. Lvs. acuminate, often 1 ft. or more long, 3 in. wide, broadly lanceolate, with a long tapering base: corolla-lobes oval. Mex. B.M. 3952 (fls. white, much flushed from the center with pale yellow). *P. acuminata* of B.R. 114. H.U. 4, p. 161, with its narrow oblong lobes and close well-defined golden center, may be a different species though commonly considered the same.—Cult. in all tropical countries for the fragrant whitish fls.; flowers all the year. Also known as the temple-flower and graveyard-flower.

The following species have been intro. and more or less cult. abroad: *P. bicolor*, Ruiz & Pav. Tree, up to 40 ft. high: lvs. oblong, acuminate, margins revolute: fls. white, yellow at throat. Peru. B.R. 480. J.H. III. 56:19.—*P. Jamesonii*, Hook. Four feet high: lvs. mostly at tips of branches: fls. yellow, deeply tinged with red. Ecuador. B.M. 4751.—*P. Lambertiana*, Lindl. Ten feet high: lvs. oblong, acuminate, flat: fls. white, yellow-throated, with broad-rhomboid obtuse segms. May to Aug. Mex. B.R. 1378.—*P. lutea*, Ruiz & Pav. Ten to 20 feet high: lvs. crowded at ends of branches, 8-18 in. long, oblong-ovate: fls. white, flushed very pale pink with a broad pale golden yellow center. Peru. B.M. 5779. G.C. III. 39:406.—*P. tricolor*, Ruiz & Pav. (*P. Kerii*, Don). Fifteen feet high: lvs. obovate-oblong, tapering at both ends: fls. with a yellow throat, white above the yellow and bright rose around the segm. margin. July-Oct. Peru. B.R. 510.—*P. tuberculata*, Lodd. Six feet high: branches tuberculate: lvs. coriaceous, narrow-oblong, tapering into the petioles: fls. white, scentless. Aug. Santo Domingo.

WILHELM MILLER.

F. TRACY HUBBARD.†



3082. Flowers of *Plumeria acutifolia*. (× 1/5)

PŌA (ancient Greek name for grass or fodder). *Gramineæ*. Mostly perennial grasses of low growth, several species of which are cultivated for forage and a few for ornament.

Spikelets 2-6-flid., in open panicles; glumes shorter than the lemmas, awnless; lemmas keeled on back, membranaceous, scarious-margined, awnless, 5-nerved,

often cobwebby at base.—About 100 species, natives of temperate and cold regions.

A. *Plants tufted, without creeping rootstocks.*

trivialis, Linn. ROUGH-STALKED MEADOW-GRASS. Resembles *P. pratensis*, from which it differs by having no creeping rootstocks, taller sts., scabrous sheaths, branches of panicle more slender and spreading, usually only 2-flid. spikelets, the lateral nerves of lemma much more conspicuous. Native of Eu., where it is a prominent pasture grass; rather sparingly cult. in this country, where it is recommended for wet pastures. Dept. Agric., Div. Agrost., Bull. No. 17:243.—A variegated form is described as var. *foliis albo-vittatis*. F.S. 16:1695.

nemorialis, Linn. WOOD MEADOW-GRASS. Panicle long and narrow, with short branches; culms 1-3 ft.; glumes 3-nerved, acuminate. Native of Eu.—Recommended for pasture or lawn in shaded situations.



3083. June-grass.—*Poa pratensis*. (× 1/4; flower enlarged)

AA. *Plants producing creeping rootstocks, thus forming a sod.*

B. *Fls. dioecious.*

arachnifera, Torr. TEXAS BLUE-GRASS. Culm 2-3 ft. high; panicle contracted, 3-8 in. long; spikelets 1/4 in. long; first glume 1-nerved, second 3-nerved; lemma copiously webby-hairy at base. A native of Texas, where it is a valuable forage grass.—It prop. by rhizomes and forms a dense sod. Recommended as a winter pasture-grass in the S. Easily distinguished from the other species by its contracted panicle and large spikelets. Dept. Agric., Div. Agrost., Bull. No. 17:246.

BB. *Fls. perfect.*

compressa, Linn. Known in the trade as CANADA BLUE-GRASS (though it is probably not native to Canada) and ENGLISH BLUE-GRASS, but the latter name is often applied to *Festuca pratensis*. Distinguished from *P. pratensis*, which it resembles, by its blue-green foliage, distinctly flattened culms, and its short and much contracted panicles. Spreads by rhizomes. Native of Eu. and extensively naturalized in this country, being found in open and rather sterile soil. Dept. Agric., Div. Agrost., Bull. No. 17:248.—It is of little value as a pasture grass except possibly on sterile soil.

pratensis, Linn. KENTUCKY BLUE-GRASS. JUNE-GRASS. Fig. 3083. Panicle pyramidal, open, usually 3-4 in. long; spikelets 3-6-flid., 1/4 in. long; first glume 1-nerved, second 3-nerved; lemma cobwebby at base; culm usually 1-2 ft. high, forming a sod with its copious rootstocks, its long soft basal lvs. producing an abundance of foliage. Native in the cooler regions of the northern hemisphere. Dept. Agric., Div. Agrost., Bull. No. 20:148.—A common pasture-grass through the middle part of the U. S. Its most important horticultural use is for lawns, for which purpose its habit and aggressiveness are eminently adapted.

A. S. HITCHCOCK.

PODACHENIUM (Greek, *foot* and *achene*, alluding to the base of the achenes). *Compósita*. Tall shrubs, one of which in southern California is said to attain a height of 30 feet, cultivated chiefly for their large and fragrant leaves.

Leaves opposite, large and angular-lobed: heads small, disposed in a broad corymbose panicle; fls. with white rays and yellow disk: achenes sparingly pilose.—Two or 3 species, Mex. to Colombia. The principal species of *Podachenium*, *P. eminens*, is commonly cult. under the name of *Ferdinandia*, which is really the oldest generic name, but this name is also used for some species of *Zaluzania*. The distinguishing feature of *Podachenium* is the shape of the achene, which is contracted at the base into a 2-winged stipe suggesting the shape of a foot. In the N. and in Eu., they are grown in the greenhouse, but they are quite hardy in the open in the S.—The fl.-heads are about 1 in. across, and about 20 or more in terminal flat-topped clusters, borne in winter and spring.

eminens, Baill. (*P. paniculatum*, Benth. *Ferdinandia eminens*, Lag. *Zaluzania eminens*, Hort. *Comphylidum cacaliaefolium*, C. Koch). A tall shrub, 9–15 ft. high, slightly branched: lvs. opposite, suborbicular or broad-ovate, base short- or long-cuneate, slightly 5–7-lobed or subentire, rather scabrous above, cinerous or subtomentose pubescent beneath: ray-fls. white, disk-fls. yellow. Mex., Guatemala. R.H. 1862, p. 110. B.M. 8502.

andinum, André. Lvs. large, coarsely lobed: fl.-heads in loose corymbs; ray-fls. white, disk-fls. yellow. Colombia. R.H. 1892, p. 414.—Said to be a useful plant for subtropical bedding.

F. TRACY HUBBARD.

PODALYRIA (named for Podalirius, the son of *Æsculapius*). *Leguminosæ*. Shrubs, with alternate simple lvs. which have subulate often deciduous stipules: infl. axillary, 1–2, rarely 3–4-fld.; calyx broad-campanulate, toothed or subequally lobed; petals subequal in length, standard suborbiculate, emarginate, slightly longer than the wings, with a short recurved claw, wings obovate, oblique, keel shorter than the wings, broad-obovate, slightly incurved; stamens free or very shortly connate at base; ovary sessile, villous, many-seeded: fr. an ovoid or oblong turgid pod with leathery valves.—About 20 species, all of them S. African. *P. sericea*, R. Br. AFRICAN SATIN-BUSH. Erect or procumbent, 4–6 ft. high, the whole plant with a satiny or silvery luster, sometimes fulvous: branches silky: lvs. obovate or cuneate-oblong, acute at base, silky on both surfaces: fls. pale-purple, solitary on the peduncles; calyx silky, lobes subulate acute, as long as the carina: fr. a silky pod. Cape Colony. Intro. into S. Calif. and also cult. abroad. The following species are mentioned as having been cult.: *P. argentea*, Salisb., *P. burifolia*, Willd., and *P. calyptrata*, Willd.

PODÁNDRIA (Greek, *foot* and *man* or *anther*, probably referring to long-stipitate anthers). *Orchidaceæ*. Terrestrial herb with radical petioled lvs. and large-fld. racemes: sepals free, lateral narrower than the dorsal, reflexed; petals simple, filiform-setaceous, erect, longer than the dorsal sepal and free from it; lip continuous with the column, shortly adnate to it, produced at the base into a long cylindrical spur; limb pendulous, 3-partite with narrow lobes, column with a short broad base, footless; anther long-stipitate, pollinia granular with very long slender caudicles; stigmas sessile, nearly confluent, situated within the side lobes of the rostellum and at their base, rostellum trilobed.—The only species is from W. Afr. The genus resembles *Habenaria*, in which it has been included, in habit but is remarkable for its enormously elongated anther and long narrow segms. *P. macrandra*, Rolfe (*Habenaria macrandra*, Lindl.). Plant $\frac{3}{4}$ –1 $\frac{3}{4}$ ft. high, apparently evergreen: lvs. elliptic-oblong, 2–5 in. long: racemes 2–9-fld.; fls.

large, white with a green tint on the sepals. G.C. III. 54:182. Intro. abroad and cult. by some orchid fanciers.

PODOCÁRPUS (Greek, *pous*, *podos*, foot, and *karpus*, fruit; alluding to the conspicuous fleshy footstalks of most species). Including *Nagbia*, *Prumnopitys* and *Stachycarpus*. *Taxdææ*. Ornamental woody plants grown for their evergreen foliage.

Resinous evergreen trees, rarely shrubs: lvs. alternate, sometimes opposite or 2-ranked, sessile or short-stalked, linear to elliptic, entire: fls. monœcious or dicecious, axillary or subterminal, solitary or in spikes; the staminate catkin-like, consisting of spirally disposed, 2-celled anthers; the pistillate consisting of a scale enclosing the ovule, with several bracts at the base, which become usually much thickened at maturity, and form a fleshy receptacle bearing at the top the globular or ovoid drupe- or nutlike seed: cotyledons 2.—Fifty-five species, chiefly in tropical and subtropical mountains of S. Amer., W. India, Asia, Afr., and Austral. Some species with the fls. in spikes and the fr. without fleshy receptacle are separated by some botanists as *Prumnopitys* (*Stachycarpus*). Many species are valuable timber trees in their native countries, and the fleshy seed-stalks of some are eaten.

The podocarpaceae are evergreen often tall trees with usually narrow, rarely elliptic, dense foliage, small flowers, the staminate yellow, the pistillate greenish and inconspicuous, and with rather small, berry-like fruit borne on usually much thickened fleshy footstalks of dark purple or purplish violet color. They are but rarely cultivated in this country and only adapted for the southern states and California, except *P. alpina*, which is the hardiest and may probably thrive as far north as Philadelphia, or even farther. They grow best in well-drained loamy soil. In the North they are sometimes grown as pot-plants in greenhouses on account of their handsome foliage; a sandy compost of loam and peat will suit the potted plants. Propagation is by seeds or by cuttings of almost ripened wood under glass; they are also sometimes grafted on any of the species which can be had in quantity.

A. Lvs. 1–8 in. long.

B. Under side of lvs. pale green or glaucescent.

C. Midrib of lvs. distinct above; width of lvs. $\frac{1}{2}$ in. or less.

macrophylla, Don (*P. longifolia*, Hort.). Tree, attaining to 50 ft., with horizontally spreading branches and pendent branchlets: lvs. alternate, pinkish when unfolding, more or less spreading, narrowly lanceolate, narrowed toward the apex and acute or obtusish, at the base gradually narrowed into a short petiole, bright green and lustrous and with a distinct midrib above, paler below, 3–4 in. long and more than $\frac{1}{2}$ in. broad: staminate fls. fascicled, sessile, about 1 in. long: seed ovoid, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, borne on a fleshy purplish violet receptacle. Japan. S.Z. 2:133. S.I.F. 1:13. G.W. 14, p. 322. Var. *Maki*, Sieb. (*P. chinensis*, Wall. *P. macrophylla* var. *chinensis*, Maxim. *P. japonica*, Sieb.). Branches upright: lvs. more upright, linear-lanceolate, obtuse or obtusish, $1\frac{3}{4}$ –3 in. long and $\frac{1}{2}$ – $\frac{3}{4}$ in. broad, with distinct midrib above: seed globose-ovoid, $\frac{1}{2}$ in. long or slightly longer. Japan, China. S.Z. 2:134. R.H. 1848:41.—Several variegated forms of this variety are in cult.

neriifolia, Don. Tree, to 70 ft., with spreading much-ramified branches: lvs. scattered, sometimes indistinctly whorled, spreading, lanceolate or narrow-lanceolate, gradually long-acuminate, at the base narrowed into a short petiole, dark green above and with the slightly raised narrow midrib in a groove, slightly glaucous beneath, 3–6 in. long, in young plants sometimes to 10 in. long, about $\frac{1}{2}$ in. broad: staminate fls. solitary or 2–3, sessile, 1–2 in. long: seed ovoid, $\frac{1}{2}$ in. long or slightly longer, with a fleshy receptacle nearly $\frac{1}{2}$ in.

long, on a stalk about $\frac{3}{4}$ in. long. Himalayas and S. W. China to New Guinea. B.M. 4655. F.S. 8:768. J.F. 3:313.

cc. *Midrib of lvs. indistinct above; width of lvs. $\frac{1}{4}$ in. or less.*

gracilior, Pilger. Tree, to 60 ft., with scattered or whorled branches: branchlets slender, winged by the decurrent lvs.: lvs. alternate, linear-lanceolate, gradually acuminate, more or less falcate, spreading, midrib indistinct above, 2-4 in. long and $\frac{1}{6}$ - $\frac{1}{4}$ in. broad: staminate fls. 1-3, axillary, $\frac{3}{4}$ -1 $\frac{1}{4}$ in. long: seed subglobose, $\frac{1}{4}$ - $\frac{3}{4}$ in. long, on a scaly, not thickened stalk. Cent. Afr.

elongata, L'Hér. Tree, to 70 ft., with more or less whorled, densely leafy branches: lvs. alternate, erect-spreading, narrowly linear-lanceolate, gradually narrowed at the apex and acute, nearly pungent; midrib inconspicuous above, $1\frac{1}{2}$ -2 in. long and about $\frac{1}{4}$ in. broad: staminate fls. solitary, axillary, sessile, about $\frac{3}{4}$ in. long: seed globose, $\frac{1}{2}$ in. across, with a short fleshy receptacle on a slender stalk about $\frac{1}{4}$ in. long. S. Afr.

bb. *Under side of lvs. with 2 glaucous lines.*

nubigena, Lindl. (*Sazegothia gracilis*, Hort.). Tree, or in cult., shrub: lvs. spreading, crowded, linear-lanceolate, acute and mucronate, pungent, somewhat revolute at the margins, dark green and with a prominent midrib above, with 2 white bands beneath, 1-1 $\frac{3}{4}$ in. long: fls. dioecious, the staminate clustered, $\frac{1}{2}$ -1 in. long: seed ovoid, $\frac{1}{4}$ in. long, on a fleshy receptacle, very short-stalked. Chile. G.C. III. 10:171.

aa. *Lvs. $\frac{1}{2}$ - $\frac{3}{4}$ in. long.*

alpina, R. Br. Shrub or small tree, attaining 15 ft., with spreading branches: lvs. indistinctly 2-ranked, linear to linear-oblong, obtuse, mucronulate, dark green, grooved or flat above, pale green beneath, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. dioecious, the staminate solitary or clustered, about $\frac{1}{2}$ in. long: seed $\frac{1}{2}$ in. long, on a fleshy receptacle. Austral.

P. andina, Poepp. (*Prumnopitys elegans*, Phil. *Stachycarpus andina*, Van Tiegh.). Tree, attaining 20 ft., with upright or somewhat spreading branches: lvs. indistinctly 2-ranked, linear, dark green above, slightly glaucous beneath, $\frac{1}{2}$ -1 $\frac{1}{4}$ in. long: fls. in spikes; receptacle not fleshy. Chile. G.C. III. 31:121. J.H.S. 37, p. 52.—*P. Bidwillii*, Hoibr.—*P. spinulosa*.—*P. chiliana*, Rich.—*P. saligna*.—*P. coreana*, Hort., incorrect spelling for *P. koraiensis*.—*Cephalotaxus Harringtonia* var. *fastigiata*.—*P. coriacea*, Rich. Tree, attaining 50 ft., with spreading branches: lvs. linear-lanceolate, acuminate, 2-4 in. long: fr. ovoid. Jamaica. Sometimes *Cephalotaxus drupacea* is cult. under this name.—*P. dactyloides*, A. Rich. Tall tree: lvs. dimorphic, on young plants linear, spreading, 2-ranked, $\frac{1}{2}$ - $\frac{1}{4}$ in. long, on older plants shorter, imbricate, appressed or spreading: seed ovoid, small: receptacle scarlet, $\frac{1}{4}$ in. long. New Zeal. G.W. 6, p. 594.—*P. formosensis*, Dümmer, from Formosa, allied to *P. Nagi*, but with smaller and thicker, lance-elliptic, obtusely truncate lvs., is not yet intro. G.C. III. 52:295.—*P. jamaicensis*, Hort.—*P. Purdieana*.—*P. koraiana*, Sieb.—*Cephalotaxus Harringtonia* var. *fastigiata*.—*P. montana*, Lodd. (*P. taxifolia*, Kunth. *Prumnopitys taxifolia*, Mast.). Tree, attaining 60 ft., with spreading branches: lvs. 2-ranked, linear, acute or obtuse, abruptly narrowed into a short petiole: fls. in spikes: no thickened receptacle. Peru, Colombia.—*P. Nagi*, Pilger (*P. Nageia*, R. Br. *Nageia japonica*, Gaertn.). Tree, attaining 90 ft., with spreading, sometimes pendulous branches: lvs. mostly opposite, ovate to oblong-lanceolate, short-acuminate, 2-3 $\frac{1}{2}$ in. long, bright green and glossy: fr. $\frac{1}{4}$ in. across, subglobose. Japan. S.Z. 2:135. R.H. 1914, p. 77.—*P. pectinatis*, Panch. (*Acropyle Pancheri*, Pilger). Tree, to 60 ft.: lvs. dimorphic, either linear, obtuse or acute, with 2 white bands beneath, about $\frac{1}{2}$ in. long, or minute, acuminate, scale-like, appressed: staminate fls. terminal: seed globose, $\frac{1}{4}$ in. across, with a thickened receptacle. New Caledonia. B.M. 7854.—*P. Purdieana*, Hook. Tree, to 120 ft., with whorled horizontal branches: allied to *P. macrophylla*: lvs. oblanceolate, obtuse, mucronulate, bright green, 2-5 in. long, $\frac{3}{4}$ in. wide. Jamaica. H.I. 7:624.—*P. saligna*, Don (*P. chiliana*, Rich.). Tree, attaining 60 ft., allied to *P. macrophylla*: lvs. linear-lanceolate, acute, slightly falcate, 3-4 $\frac{1}{4}$ in. long: staminate fls. clustered, about 1 in. long. Chile, Peru.—*P. spicata*, R. Br. (*Prumnopitys spicata*, Mast.). Tree, attaining 80 ft.: lvs. 2-ranked, linear, obtusish, sessile, $\frac{1}{2}$ - $\frac{1}{4}$ in. long: fls. in spikes: receptacle not thickened. New Zeal. H.I. 6:543.—*P. spinulosa*, R. Br. (*P. Bidwillii*, Hoibr.). Allied to *P. macrophylla*. Tree: lvs. upright, linear, acuminate and spiny-pointed, midrib distinct above, $1\frac{1}{2}$ -3 in. long. Austral.—*P. taxifolia*, Kunth.—*P. montana*.—*P. Totara*, A.

Cunn. (*P. Totara*, Don). Tree, attaining 90 ft. with spreading branches: allied to *P. alpina*: lvs. linear, acute or acuminate, $\frac{1}{2}$ -1 $\frac{1}{4}$ in. long. New Zeal.

ALFRED REHDER.

PODÓLEPIS (Greek, *foot and scale*; referring to the unusual fact that the involucre scales have a foot-stalk or claw). *Compositae*. Australian herbs with yellow, pink or purple rays, a few of which are cultivated as half-hardy annuals.

Plants 6-12 in. high and bearing fls. which are chiefly interesting as representing an intermediate stage between the common type of composite with showy rays and the "everlasting fls." like *Helichrysum*, in which the rays are aborted and the showy parts are the stiff involucre scales. In *Podolepis* the involucre scales are generally colored, but are thin and nearly transparent, and overlap one another instead of standing out like petals.—About 16 species belonging to an unfamiliar group of composites from Australia. Very little in cult. in America. The following species are annuals with linear or lanceolate lvs. and hemispherical involucre $\frac{1}{2}$ - $\frac{3}{4}$ in. diam. They need a porous soil with full exposure to the sun, and they also do well in pots. See *Annuals*.

A. *Color of rays yellow.*

B. *Involucre bracts acute.*

canescens, A. Cunn. (*P. affinis*, Sond.). Rarely much exceeding 1 ft.: lvs. mostly all basal, linear or linear-lanceolate, 1-2 in. long: involucre bracts slightly or not at all rugose; claws with broad scarious margins: rays 3-4 lobed slightly longer than the disk-fls.



3084. *Podolepis aristata*. (X $\frac{1}{4}$)

BB. *Involucre bracts acuminate.*

aristata, Benth. (*P. chrysantha*, Endl.). Fig. 3084. Often exceeding 1 ft.: lvs. linear or lanceolate mostly st.-claspings and decurrent: involucre bracts not rugose, usually ending in a rigid point or awn, the claws of the inner ones narrow and glandular: rays longer than the disk-fls., 3-4 lobed. R.H. 1857, p. 263.

AA. *Color of rays purple or lilac.*

gracilis, Graham. Often exceeding 1 ft., the smooth st. usually much branched: lvs. linear, st.-claspings and often slightly decurrent: involucre bracts obtuse; claws narrow, glandular: rays entire or 2-lobed, $\frac{1}{2}$ in. long: pappus not thickened upward. B.M. 2904 (disk-fls. mostly purple, some yellow).

WILHELM MILLER.
N. TAYLOR.†

PODOLÓBIUM: *Oxylobium*.

PODOPHYLLUM (from Tournefort's *anapodophyllum*, duck's-foot-leaf; from a fancied resemblance in the foliage). *Berberidaceae*. MAY APPLE. MANDRAKE (erroneously). Herbs common in rich woods and copses throughout the eastern United States, a colony of which is most desirable for a wild garden.

Hardy perennials herbs: sepals 6, petal-like; petals 6-9; stamens as many or twice as many as the petals;

pistil 1 (rarely several): berry with many seeds, which are inclosed in fleshy arils.—*Podophyllum* is a genus of about 5 species,—1 American, 1 Himalayan and 3 from China.

The May apple is one of the most prominent of the native low-growing spring herbs. The "apples" are yellowish egg-shaped fruits about 2 inches long, and have a rather mawkish taste. The leaves are very distinct, being shaped like a round shield with 5 to 7 lobes. The plant has two kinds of leaves, the solitary ones, and the others in pairs. The large centrally petate leaves have no flower underneath. The flowers are nodding white waxlike cups which spring from the fork of the stem. They have a rather unpleasant smell.

Some parts of the May apple plant are emetic and poisonous. Extract of *podophyllum* is common in drug-stores. For the drug trade, the rhizomes are collected late in summer and dried, the supply coming mostly from the Central States.

The plants are offered by several dealers in hardy herbaceous perennials. They are of easy culture, re-



3085. Royal poinciana.—*Poinciana regia*.

quiring deep rich soil and partial shade. They are useful only for spring effects, however, as the foliage dies down by midsummer or before. Later-growing vigorous perennials, as *Polygonatum giganteum*, may be associated with a planting of May apple, to occupy the ground in the later part of the season. *P. Emodii* requires a moister situation, and some prepare a peaty soil for it. Propagation is by division or by seed. The mandrake of Old World history and romance, is *Mandragora*.

A. *Frs. yellowish.*

peltatum, Linn. MAY APPLE. MANDRAKE (see *Mandragora*, Vol. IV, p. 1982). Height 1-1½ ft.: lvs. dark green, nearly 1 ft. across, 5-7-lobed, each lobe 2-cleft; fls. about 2 in. across. Also called wild lemon and hog apple. B.M. 1819. Gn. 21, p. 127. B.B. 2:92.—Blooms in April and fruits in May. It is a shade-loving species, although growing also in partial sun in moist and rich soil, from W. Quebec and W. New Eng. to Minn. and south to Fla. and Texas.

AA. *Frs. deep red.*

emodii, Wall. Lvs. 3-5-lobed; fls. white or pale rose; fr. large as a hen's egg, brilliant red. Himalayas. G.C.

II. 18:241.—The foliage is a fine bronzy red in early spring, said to be edible.

P. versipelle, Hance. A perennial herb, with sts. about 3 ft. high, 2-forked at top, each fork bearing a lobed petate lf.: fls. pendulous, crimson, in clusters of 12-16 just under the lvs. China. Intro. into England. B.M. 8154. F. TRACY HUBBARD.†

PODOSTIGMA (Greek words referring to the fact that the stigma has a foot or stalk). *Asclepiadaceæ*. This includes a half-hardy tuberous-rooted perennial herb which grows a foot high or less in low pine-barrens from N. C. to Fla. and bears in summer small greenish yellow fls. The genus is closely allied to *Asclepias*, and is distinguished by having the hoods remote from the anthers at the base of the long column, while in *Asclepias* the hoods are approximate to the anthers. *P. pedicellata*, Vail. Lvs. opposite, linear-lanceolate, nearly sessile; peduncles terminal and axillary, umbellately several-fld. The only species.—Advertised in 1881, but presumably not hardy N.

POGONIA (Greek, *beard*; alluding to bearded labelum). *Orchidaceæ*. Hardy terrestrial orchids.

Mostly small perennial herbs, with erect slender sts.: fls. solitary or in racemes; sepals and petals free, erect or ascending; labellum sessile, with broad base, spurless, with longitudinal ridges.—About 40 species, N. and S. Amer., with exception of 2 Chino-Japanese species. *Pogonias* are delicate plants requiring care in planting. The woodland species should have rich leaf-mold, with deep shade; the swamp species require peat or suitable light, rich soil, moist yet not wet. All the species are preferably planted in spring.

A. *Sepals and petals nearly equal in length.*

ophioglossoides, Ker. St. 8-15 in. high, slender, 1-3-lvd.: lvs. 1-3 in. long, lanceolate or ovate; fls. solitary or in pairs, fragrant, pale rose, subtended by a foliaceous bract. June, July. In meadows and swamps, U. S. B.R. 148. G.F. 10:485. V. 2:269; 11:229.—This seems to be the only species that can be grown with success. It thrives in wet moss in boxes of sphagnum. Usually it is better to transplant from the wild each year than to attempt to prop. the plants. Sometimes it can be colonized in wet meadows.

AA. *Sepals longer than the petals.*

divaricata, R. Br. St. 1-2 ft. high, slender, bearing a solitary fl.: fl. 1 in. long; sepals dark; petals flesh-colored; lip as long as petals, greenish, veined with purple. July. Swamps, N. J. to Fla. B.B. 1:468.

P. pendula, Lindl.=Triphora.—*P. verticillata*, Nutt.=Isotria.

HEINRICH HASSELBRING.

POGOSTEMON (Greek, *bearded stamen*). *Labiataæ*. This includes the plant which produces the well-known perfumes called patchouli, or in India pucha-pat.

Herbs or subshrubs: lvs. opposite, rarely in 3's; fls. small, in solitary or panicle spikes formed of many dense whorls; calyx subequally 4-5-toothed; corolla-tube exserted or included; limb sub-2-lipped; lobes 4, lower usually longest; stamens 4, exserted, straight or declinate; filaments usually bearded; anther-cells confluent; nutlets smooth, ovoid or oblong.—About 40 species, 24 of which are distinguished in Flora of British India 4:631.

Patchouli has a peculiar dry moldy smell and is one of the commonest perfumes in India. In the 1840's its presence was considered the sure test of a genuine Indian shawl, but the French manufacturers of imitation Indian shawls imported the perfume in the 1850's. Patchouli is no longer fashionable. Fuller accounts of it will be found in the "Cultural Industries of Queens-

land," V. 8:247 and Gn. 27, p. 447. The plant has no ornamental value. Live plants were introduced into southern California, and were offered in 1900 in the East.

Heyneanus, Benth. (*P. Patchouly*, Pellet.). **PAR-CHOULI PLANT**. Herb, 2-3 ft. high: lvs. long-stalked, ovate, acute, acuminate or obtuse, crenate, simply or doubly toothed: spikes terminal and axillary, forming a paniced infl.; whorls usually separate, forming interrupted spikes; fls. whitish, tinged purple. India and Burma.

POINCIANA (M. de Poinci, governor of the Antilles in the seventeenth century). *Leguminosae*. Small mostly broad-topped unarmed trees, with large and very showy flowers; one of the most conspicuous trees in southern Florida and the American tropics.

Leaves bipinnate with numerous small lfts. and with no stipels and inconspicuous stipules: fls. very showy, orange or scarlet, in large corymbose racemes, not papilionaceous, the 5 petals clawed and eroded or even fimbriate on the margin, the stamens 10 and free and exserted: fr. long and flat.—There are 2 or 3 species of Poinciana, all native to the oriental tropics. The genus has been confounded with *Casalpinia*, but the calyx-segms. are valvate, whereas they are strongly imbricate (or overlapping) in *Casalpinia*. The *P. pulcherrima*, known as "Barbados pride" and "bird-of-paradise flower," is *Casalpinia pulcherrima*; *P. Gilliesii* is *C. Gilliesii*. *P. elata*, Linn., native to India, Arabia, and Trop. Afr., is planted in the Old World, but is not in the American trade. It reaches a height of 20-30 ft., with the petals scarcely exserted beyond the calyx.

Conzattii, Rose. Small tree, with grayish bark: lvs. glabrous, large, with commonly 4 pairs of pinnæ; lfts. 4 or 5 pairs, oblong to obovate: infl. a sessile raceme; sepals highly colored, obtuse; petals yellowish red: pod scythe-shaped, pubescent. Mex.—Cult. in Mex. and S. Calif.

regia, Boj. **ROYAL POINCIANA. PEACOCK FLOWER. FLOMBYANT**. Figs. 3085-3087. Rapid-growing tree, reaching 20-40 ft., and making a wide-spreading picturesque top: lvs. 1-2 ft. long, with 10-20 pairs of pinnæ, each pinna with numerous oval lfts.: fls. 3-4 in. across, bright scarlet (upper petal striped with yellow and more cuneate), the obovate petals very prominently clawed (or narrow below): pod 6 in. to 2 ft. long. Madagascar. B.M. 2884.

Now a popular tree in frostless countries, as in S. Fla., S. Calif., Bermuda, and the W. Indian Isls. It is deciduous. One of the most striking and gorgeous of tropical trees. Sometimes seen under glass in the N. *Casalpinia pulcherrima* is often confounded with it; but that plant is a shrub or at most only a small tree, with strongly overlapping calyx-segms. in the bud, smaller fls., and very long-exserted stamens. L. H. B.

POINSETTIA (*Euphorbia pulcherrima*, which see), is one of the most popular plants for the Christmas season. It is a

shrub of tropical America with inconspicuous flowers but with flaming red leaves or bracts (with variations to pink and white), clustered near the top. It is for these leaves that the plant is grown (Fig. 1440, Vol. II).



3087.
Poinciana regia.



3086. Poinciana regia. (X 1/2)

Poinsettias require rather a long period of rest. After the bracts are cut, lay them on their side near the pipes under a carnation-house bench. About the first of May is the best time to start them for cuttings. They should then be placed on a light bench in the full sun in a temperature of not less than 60°. The eyes will start into growth near the top of the cane, and by June 1 one can take the first batch of cuttings. These are found most suitable for stock plants as they grow rather tall to be of much use for decorative purposes. Pot the cuttings singly in small pots in sand. It is better to have a little sphagnum moss in the bottom of each pot for the roots to grip. Place them in a tight case shaded from the sun. The temperature should never be less than 65°. Water the cuttings every morning until they root, except on dull days. When rooted, pot them in 3 1/2-inch pots in equal parts of loam, leaf-mold, and sand. The next shift may be a 6-inch pot, and a good fibrous loam with a sixth part of sheep-manure added. They will form a fine large bract in this size pot, and require no further potting although they should be fed with manure-water until the yellow flower appears in the center of the bracts. After the first batch of cuttings has been removed, the stock plants should be planted out-of-doors. One gets far firmer and as many cuttings by this treatment, and the cuttings now secured and rooted may be used in various ways. Twelve cuttings rooted as advised above and placed in a 10-inch pot make a fine specimen plant for Christmas. Others may be grown about 2 feet high for single-stem plants. The last cuttings to be rooted for the season should be secured not later than the middle of August, and they are excellent for making up shallow pans for centerpieces for Christmas. Poinsettias should at all times be grown as near the glass as possible, and during the summer months the house should have full air day and night. Never, however, allow the temperature to drop below 60°, and avoid draughts, as this will tend to make the foliage drop, and the retaining of the leaves is one of the attractive points in a well-grown plant of poinsettia. Insect pests that attack the poinsettia can be eradicated by the use of hydrocyanic gas, as advised for other plants.

GEORGE F. STEWART.

POISON BERRY: *Cestrum*. P. Dogwood: *Rhus vernix*. P. Elder: *Rhus venenata*. P. Hemlock: *Conium maculatum*. P. Ivy: *Rhus Toxicodendron*. P. Oak: *Rhus Toxicodendron*. P. Sumac: *Rhus vernix*.

POISONOUS PLANTS. The plants that are injurious to man and the domestic animals may be divided into two groups: (1) those that cause injury by mechanical means; and (2) those that are poisonous.



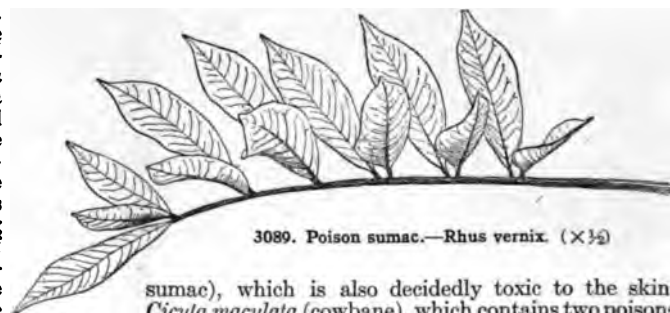
3088. Leaf of poison ivy. ($\times \frac{1}{4}$)

The first group includes those plants which are mainly harmful to farm cattle, causing serious troubles which may result eventually in the death of the animal. This group includes such plants as the crimson clover, *Trifolium incarnatum*, spiny cacti (*Opuntia*), the hairs and spines of which form the hair- and spine-balls known as phyto-bezoars. The branched hairs of the calyx of the crimson clover, if eaten by horses and cattle, when in full flower, are rolled together to form the hair-balls which have been responsible for the death of many animals. The spines of species of *Opuntia* in Mexico and the southwestern United States cause the laceration of the mouth and tongue of cattle and death has resulted in a number of cases, where these spines have been rolled into phyto-bezoars. *Agagropilae* are balls formed from animal hairs which have been licked off and swallowed. Through the peristaltic movement of the intestines these have been rolled into balls. The silex in the stems of the scouring-rushes (*Equisetum*) is responsible for inflammation of the digestive organs of cattle. The hygrometric structures attached to the fruits of such grasses as *Stipa capillata* (Russia), *S. spartea* (United States), *Aristida hygrometrica* (Queensland), and *Heteropogon contortus* (New Caledonia), by their spiral movements cause the pointed ends of the fruits to bore into the skin and flesh of animals in those regions of the earth. The blue-mold, *Aspergillus fumigatus*, which lives at blood temperature, penetrates the lung tissues of calves and pigeons, and its masses of spores fill up the air-cavities and lung-passages, causing asphyxiation. These are some of the illustrations of plants that kill, or cause injury, by mechanical means.

The poisonous plants, however, are those that contain some chemical poison which either produces irritation, disease, or death by its direct action. The season of the year has a direct influence on the activity of a poisonous plant. Melter (1899) records that his horse ate 500 pounds of the dried hay of *Passiflora incarnata* in August without injury, while in March, eight months later, 25 pounds of the hay of this plant

killed another horse. The condition or age of the plant is important. The poisonous principle in the spotted hemlock, *Conium maculatum*, is volatile, and hence the dried plant is less poisonous than the fresh. The leaves of wild black cherry, *Prunus serotina*, are more poisonous when dry than when fresh, owing to the development of hydrocyanic acid. Some parts of a plant are more poisonous than others. For example, the seeds of the Jamestown weed, *Datura Stramonium*, are more deadly than the remainder of the plant. Again it may be said that the relative amounts of poisonous substance vary in different individuals of the same species and that small doses of some poisons are taken with beneficial results, for instance the use in medicine of belladonna, strychnine, and aconite. The toxic properties of plants are not due in all cases to the same chemical substance. It is well known that several plants contain a number of toxic bodies. For example, the green hellebore, *Veratrum viride*, contains the alkaloids jervin, cevadin, and veratrin. Sometimes the same poison is present in more than one species, as solanin in the tomato and the potato. Not all animals are equally affected by the same poison, as for example, the daniel which poisons men, dogs, horses, and sheep, but is innocuous to cows, pigs, and ducks. Some persons are susceptible to poison ivy, others are not. This susceptibility may be increased by sickness, or a run-down condition. Some animals acquire a craving for certain injurious plants, as for example, the loco weeds of the United States, stemless loco weed, *Oxytropis Lambertii*, and in Australia, according to Maiden, the indigo plant, *Swainsona galegifolia*. Kobert divides poisonous plants into three groups: (1) irritants which cause gross anatomic changes, as croton-oil; (2) blood poisons, as ricin; (3) poisons which kill without anatomic changes, as morphin, digitalin, and the like; and a fourth class may be added, (4) skin-irritants, as poison ivy.

The most poisonous lower plants are fungi belonging to the genus *Amanita*. The two most virulent are the toadstools, *Amanita muscaria*, which contains muscarin, and *A. phalloides* with phallin. Fortunately, an antidote has been discovered for the first in the administration of hypodermic injections of atropin beginning with 1-100 of a grain, and increasing the dose to a strength of 1-60 of a grain. For phallin, no antidote is known. Of the higher plants, the most noted poisonous ones are: *Aconitum Napellus* (monkshood); *Delphinium Geyeri* (larkspur); *Oxytropis Lambertii* and *Astragalus mollissimus* (loco weeds); *Rhus radicans* (poison ivy), which is a serious skin-irritant; *Rhus vernix* (poison



3089. Poison sumac.—*Rhus vernix*. ($\times \frac{1}{2}$)

sumac), which is also decidedly toxic to the skin; *Cicula maculata* (cowbane), which contains two poisons conin and cicutoxin; *Conium maculatum*, the classic poisonous plant, from which came the death-draught of the philosopher Socrates; *Kalmia latifolia* and *K. angustifolia*, the two poisonous laurels; *Datura Stramonium* (Jamestown weed); *Atropa Belladonna* (deadly nightshade) and others too numerous to mention.

Popular interest usually attaches to the poison ivy, *Rhus radicans* or *R. Toxicodendron* (Fig. 3088), a root-climbing vine with ternate leaves, and the poison

sumac, *Rhus vernix* (Fig. 3089), with pinnate leaves. Both of these plants have white fruits and hence are easily distinguished from the non-poisonous sumacs. The poison ivy is everywhere in the eastern states along roads, fence-rows and uncultivated ground, while the poison sumac grows in swamps and is less common. Both are skin-irritants, causing what physicians call dermatitis. If the susceptible person thinks he has come into contact with the plants, he should wash his hands and face with alcohol, as this dissolves and removes the non-volatile oil, toxicodendrol. Smoke from a brushwood fire containing these plants is toxic, and so is the Japanese lacquer made from the inspissated juice of a sumac, *Rhus vernicifera*. Unfortunately, all parts of these plants are virulent and at all seasons of the year. One of the best remedies is an alcoholic solution of sugar of lead, and the extract of grindelia (sold at drug-stores) is sometimes used. Local remedies are fresh bean leaves, stems of touch-me-not (*Impatiens*) and plantain leaves (*Plantago lanceolata*). At least, these leaves allay the burning sensation of the inflamed skin. An authoritative work on toxic plants is the "Manual of Poisonous Plants," by L. H. Pammel, professor of botany in Iowa State College of Agriculture, in two parts, Part I (1910) and Part II (1911) with a total of 977 pages. Other publications have been issued.

Two plants much in prominence at the present time in Wyoming on account of their poisonous effect on livestock are discussed by H. G. Knight, as follows: "Woody aster, *Xylorrhiza Parryi* (Fig. 3090), is found throughout the state of Wyoming, but is confined to certain districts characterized by a gumbo clay soil, more or less intermixed with gravel and containing more or less of alkali and other salts. This plant probably causes greater losses among sheep in the state of Wyoming than all other poisonous plants together, but may be easily recognized by those familiar with the range. So far as is known, sheep are the only species of range animal susceptible to poisoning by woody aster. No antidote is known and there is much question whether a satisfactory antidote will be obtained as the action of the poison is powerful and death comes speedily with many pathological changes."

Pammel writes, "Death camas, *Zygadenus intermedius*, is a near relative of the better known *Zygadenus venenosus*. In Wyoming the most common species is the *Z. intermedius* and the greatest losses noted have occurred in early spring when the plant is in bloom, and before early forage is plentiful. The plant grows on the sandy plain as well as in the drier and stonier foothills. It has been found that the poisonous properties are due to the presence of alkaloids, one of which at least is new to science. An antidote has not as yet been determined."

JOHN W. HARSEBERGER.

POIVREA (N. Poivre, 1719-86; intendant of Mauritius). *Combretaceae*. Mostly climbing shrubs: lvs. opposite or alternate, entire; spikes axillary and terminal; calyx 5-lobed; petals 5; stamens 10, protruded; ovary 2-3-ovuled: fr. oval or oblong or 5-winged; seed solitary, pendulous, 5-angled. It includes a S. African shrub with orange-red fls. cult. in S. Fla. and Calif. The genus is referred by Bentham & Hooker to *Combretum*, a large genus containing some handsome plants that are little known. Poivre differs from the other *combretums* chiefly in the convolute cotyledons. *P. bracteosa*, Hochst. Unarmed shrub 8-10 ft. high: lvs. opposite or in 3's, $2\frac{1}{2}$ -3 x 1-1 $\frac{1}{2}$ in.: petals clawed, reddish, 4 lines long: fr. oval, indistinctly 5-angled. Called "hiccup-nut" in Cape Colony. *P. comoda*, Sweet. A large climber with great panicles of blood-red fls.: fr. short-stalked, notched at both ends. Trop. Afr. B.R. 1165 (as *Combretum comosum*).

POKER PLANT: *Kniphofia*.

POKEWEED: *Phytolacca*.

POLANISIA (Greek, *many, unequal*, referring to the stamens). *Capparidaceae*. Annual herbs, mostly glandular and having an unpleasant odor: lvs. palmately 3-5-foliate, the uppermost reduced to bracts of the racemose fls.: fls. whitish or yellowish; sepals 4, lanceolate, deciduous; petals slender or clawed; receptacle depressed, bearing a gland at the base of the ovary; stamens 8 to numerous, somewhat unequal: fr. a nearly or quite sessile pod.—About 30 species, natives of temperate and tropical regions, of little value horticulturally. *P. trachysperma*, Torr. & Gray. A branched glandular-pubescent viscidous annual, 1-2 ft. high: lvs. petioled, with 3 oblong lfts.: fls. yellowish white in terminal racemes, rather large: fr. a caps. more or less contracted at base, not stipitate. N. Amer. Intro. abroad.

POLEMONIUM (ancient name, not explained; probably not from Greek *polemos*, war, but rather the philosopher Poleman). JACOB'S LADDER. GREEK



3090. Woody aster (*Aster*, or *Xylorrhiza*, Parryi), a poisonous plant of the Plains.

VALERIAN. *Polemoniaceae*. Flower-garden herbs, with pinnate leaves and pretty blue, purplish white or yellowish flowers.

Perennials, rarely annuals or biennials, tall or dwarf, often viscid, often with a creeping rhizome which is thick or slender: lvs. alternate, odd-pinnate or pinnatisect: fls. in racemes or thyrses-like panicles; calyx increasing after anthesis; corolla tubular, funnel-shaped, broadly bell-shaped or subrotate, 5-lobed, the lobes mostly obovate; stamens 5, alternate, with corolla-lobes inserted near the base, included or exserted: caps. 3-valved. Closely allied to *Gilia* and distinguished by the declinate stamens and the filaments usually pilose-appendaged at the base.—Brand, in the recent monograph (Engler's *Pflanzenreich*, IV. 250, hft. 27, 1907) accepts 29 species; mostly W. N. American, extending into Mex., but also in Eu., Asia and 2 in S. Amer.

This genus includes the Jacob's ladder, *P. caeruleum*, an old-fashioned inhabitant of cottage gardens, which owes its popular name to the regular manner in which the numerous leaflets are arranged on the long leaves. It is a hardy perennial herb, growing 1 to 3 feet high and bearing five-lobed bell-shaped flowers of blue or white, and nearly an inch across. Probably the finest species, however, is the plant known to all gardeners as *P. Richardsonii*, which is a form of *P. humile* (or *P. lanatum*) that has doubled or trebled in size in cultivation. A fine specimen of *P. Richardsonii* may have a terminal cluster $6\frac{1}{2}$ inches across and 5 inches deep, with two dozen flowers each $1\frac{1}{4}$ inches across. *P. confertum* differs in the great density of its inflorescence, and by connoisseurs in alpine plants may be regarded as a very fine species. Most of the yellow-flowered forms are disappointing. Polemoniums are of easy culture in any deep rich loamy soil. *P. caeruleum* and *P. reptans* do well in partly shaded places not too dry.

Polemoniums are easily raised from fall-sown seed. Also propagated by division. They are said to be impatient of soil on the leaves.

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A. *Corolla tubular or funnel-form, the tube longer than the lobes.*

1. *pauciflorum*, Wats. Perennial, erect and branched, somewhat villous, 1-2 ft.: lfts. 8-13 pairs, about 1 in. long: fls. yellowish, tubular, the tube 1-1¼ in. long, much longer than the lobes, solitary or loosely corymbose, long-pedunculate; stamens bearded at base, about equaling the corolla: caps. oblong. Mex.—The color is said to be a good clear yellow, tinged red outside. Offered by J. W. Manning in 1892, but subsequently dropped.

2. *confertum*, Gray. Perennial, with a thick woody rhizome, sticky, smelling of musk, 9-18 in. high: lfts. very small and so crowded as to seem whorled: infl. a dense head; fls. honey-scented, deep blue, ½-1 in. long; corolla narrowly funnel-shaped; filaments naked or nearly so and not dilated at base. Rockies and Sierras. Gn. 10:506. G.C. II. 24:12; III. 27:237. G.M. 55:459. G.W. 7, p. 356.—Intermediate between Polemonium and Gilia.

3. *mellitum*, A. Nels. (*P. confertum* var. *mellitum*, Gray). An attractive species with white or pale fls., the



3091. *Polemonium reptans*. The leaflets are often much broader. (×½)

plant usually taller than *P. confertum* and the infl. more lax and leafy and becoming racemose or spike-like: corolla fully 1 in. long, the lobes only one-third or one-fourth the length of the tube: herbage heavily musk-scented, fls. honey-scented (whence the name). Rocky Mts. Nev. Gn.W. 25:557.

AA. *Corolla campanulate to rotate, the tube mostly shorter than the lobes.*

B. *Plants low, with thickened rootstocks: lfts. seldom ½ in. long.*

4. *humile*, Willd. (*P. Richardsonii*, Graham). Low, slender plant from somewhat creeping rootstocks, about 9 in. high: lfts. 15-21, 2-6 lines long: fls. bell-shaped, blue or purplish. July, Aug. Arctic regions. B.M. 2800 (yellow eye). G.C. II. 19:793. B.R. 1303 (as *P. caeruleum* var. *piliferum*).—It has the odor of ripened grapes. Brand combines this plant with *P. lanatum*, Pallas, of the Arctic Zone and the Altai region, making this form *P. lanatum* var. *humile*, Brand, with a wide range in the high N. *P. Richardsonii*, referred here, was raised from seeds collected at Great Bear Lake. The plant cult. as *P. Richardsonii* grows about 18 in. high, and bears profusely of bright blue fls. (varying to white in var. *album*, Hort.); probably the best of the genus, and in need of botanical study. Aside from references above, portraits occur in Gn. 78, p. 615; G.M. 45:494; Gn.W. 5:757; J.H. III. 54:101.

Var. *pulchellum*, Gray (*P. pulchellum*, Bunge. *P. lanatum* var. *pulchellum*, Brand). Differs in having smaller fls. ranging from violet and lavender to nearly white and in the viscid pubescence, which is minute. Arctic coast and southward according to Gray, but restricted by Brand to Asia (Altai region).

5. *pulcherrimum*, Hook. (*P. pumilum* var. *pulchellum*, Rydb.). By Gray considered to be a more viscid lax or diffuse and small-fl. form of *P. humile* var. *pulchellum*, the corolla violet varying to white, and with narrower lobes. By Brand it is made to comprise the American forms passing as *P. humile* var. *pulchellum*, with much smaller fls.: sts. erect, more or less pilose and glandular-viscid, 10 or 12 in. or less high: radical lvs. numerous, the lfts. 17-27, small, ovate, obtuse and entire; st.-lvs. few: fls. in terminal corymbs, the corolla very variable, usually bicolor (blue with white tube), 5-8 lines long, the lobes oblong and much exceeding the short tube: caps. ovoid, much shorter than the calyx. High Rocky Mts. and northward. B.M. 2979. B.R. 1304 (as *P. humile*). Gt. 9:292 (as *P. pulchellum*).

BB. *Plants weak and rather low, with a short rootstock: lfts. ½-1½ in. long.*

6. *reptans*, Linn. GREEK VALERIAN. Fig. 3091. Height 1 ft. or less: slender, weak and diffuse but never creeping (as the name would indicate): foliage not viscid or glandular; lfts. 5-15, from lance-oblong to broad-ovate, acute, entire: fls. light blue, ½ in. across, in a loose panicle-like cluster terminating the st.; corolla ½-¾ in. long in cult., about ½ in. or more broad; calyx-lobes acute or obtuse; stamens not exerted: caps. about 3-seeded. Open woods, N. Y. to Ala., west to Minn. and Kans. April, May. B.M. 1887.—Said to be an easy prey to snails, especially in winter, when they attack the rootstocks.

7. *carneum*, Gray. St. lax or loosely branching, 1-2 ft. high, with a horizontal rootstock: lfts. 5-17, often 1½ in. long, ovate to oblong-lanceolate: fls. salmon or flesh-color fading to purplish, 1-1½ in. across, the corolla-lobes rounded-obovate; calyx deeply 5-cleft, with ovate-oblong lobes. Mountain woods, Calif., Ore. G.C. III. 48:134.—Offered in Ore., 1892, but probably not in cult. now. Closely allied to *P. reptans*.

BBB. *Plants strong and erect, mostly tall, with slender rootstocks or roots: lfts. usually large.*

C. *Fls. not blue (seldom running to violet), yellowish, cream-color or salmon.*

8. *foliosissimum*, Gray. Sts. solitary and erect, 1-3 ft. tall, simple or branched, hairy at base and viscid above, from a woody short rootstock: herbage strong-scented; lvs. many; lfts. lanceolate to ovate-lanceo-

late, usually less than 1 in. long: fls. commonly white or cream-colored, rarely violet, an inch or less long, corymbose-cymose, the corolla twice the length of the calyx; stamens and style not exserted: caps. nearly globose. Rocky Mts.—Cult. some years ago, but perhaps never offered in Amer.

cc. Fls. blue (to white).

9. *cæruleum*, Linn. JACOB'S LADDER. CHARITY. Fig. 3092. Stout perennial herb, erect and leafy, 1–3 ft.: st. lightly hairy or nearly smooth, more or less glandular, angled: radical lvs. forming dense tufts, on petioles 6 in. or more long, the lfts. 11–21, lanceolate and mostly acuminate, entire; st.-lvs. smaller, very short-petioled or sessile near top of st.: fls. blue, many drooping in a panicle (frs. erect), 1 in. or less diam., the stamens not exserted; style protruded; corolla-lobes broad and spreading, subacute or mucronulate; calyx campanulate, with oblong acute lobes: caps. included in the calyx. Eu., mostly in copses and along streams, in moist or wet ground. Var. *album*, Hort. (*P. album*, Hort.), with white fls., is almost as popular as the type. Var. *variegatum*, Hort., has variegated foliage. There is also a dwarf form.—*P. cæruleum* is widespread and variable, and the geographic forms are sometimes set off as species. Var. *himalayanum*, Baker (*P. himalayana*, Baker). *P. grandiflorum*, Hort., not Benth. *P. cæruleum* var. *grandiflorum*, J. W. Manning, is the Himalayan form, with large fls. $1\frac{1}{2}$ in. across, lilac-blue or darker, the rounded lobes nearly $\frac{1}{2}$ in. across; calyx and axis of panicle very hairy. In separating the American forms, much is made of the character of the rootstock. Greene, who has studied them, describes the true *P. cæruleum* of Eu. and of gardens as having a tap-root surmounted by a stout short simple or branching very leafy crown standing above ground. Hooker, however, speaks of the rootstock as short, creeping. The E. American representative, native in cold swamps and along streams, Vt. to Md., and probably not in regular cult., is now separated as *P. Van-Bruntiae*, Brit.; from *P. cæruleum* it differs in having horizontal stout rootstocks, more leafy st., exserted stamens, rounded (not mucronulate) petals, accrescent calyx which becomes twice or three times the size of that of *P. cæruleum*, broader and fewer lfts., and fewer ovules. It bears considerable resemblance to *P. reptans*, but that species has a diffuse habit, fls. half the size, stamens included and calyx lobed only about one-third its length, the lobes obtuse. This species bears the name of Mrs. Van Brunt. The Rocky Mountain representative is separated as *P. occidentale*, Greene, differing from *P. cæruleum* in having slender rootstocks, upper part of st. viscid-pubescent, lfts. narrower, lanceolate, stamens only the length of the corolla, the fruiting calyx not nearly so large and the lobes obtuse or obtusish.

L. H. B.†



3092. *Polemonium cæruleum*.

POLIANTHES (name discussed below). *Amaryllidaceæ*. TUBEROSE. Tender summer-flowering bulb, producing long spikes of very fragrant blossoms; by successional plantings, it may be had at different seasons; commonly double-flowered.

Developed lvs. mostly basal, those on the st. short: perianth white; tube long, narrowly funnel-shaped, curved; segms. short, subequal; stamens affixed at the middle of the tube, not exserted; ovary 3-celled, free at apex; stigmas 3, ovate, falcate: fr. crowned by the persistent perianth; seeds flat.—As defined by Rose (1903), the genus contains about a dozen species, Mexican, and Bravoa is not clearly distinct. The common tuberose, *P. tuberosa*, is unknown in a wild state; if it had its origin from any of the Mexican species, it must have come from *P. gracilis*. Possibly it is native in the Andes of S. Amer.

The name Polianthes was given to the tuberose by Linnæus in 1737 in his "Genera Plantarum." Unfortunately he wrote "Polyanthes" in another work, published in 1737. This was probably an error. Some writers have changed the spelling to Polyanthus, supposing that Linnæus had in mind the idea of "many-flowered," from *polys* and *anthos*. Others have supposed he derived it from *polis*, a city. It seems probable, however, as Benth & Hooker suggest, that Linnæus had in mind *polios*, "shining," "white," and *anthos*, "flower," which is much more applicable to the tuberose than are the other derivations. Consult *Polyanthus* for other meanings of the word Polyanthus. The name "tuberose" is derived from *tuberosa*, this plant being the tuberous hyacinth as distinguished from the bulbous hyacinth. The name therefore is *tuber-ose*, not *tube-rose*.

tuberosa, Linn. TUBEROSE. Fig. 3093. Rootstock tuberous: sts. in clusters, 2–3½ ft. high: basal lvs. 6–9 to a st., 1–1½ ft. long, ½ in. or less wide, bright green, reddish near the base: st. with 8–12 reduced lvs.: fls. $1\frac{1}{2}$ –2½ in. long, pure waxy white, borne in pairs in a lax spike; segms. ½–¾ in. long, the tube bent only near the base; filaments attached on upper part of corolla. B.M. 1817. B.R. 63. R.H. 1882, p. 429. F. 1881, p. 27. Gn. 47, p. 330. It runs into double forms. Gn.W. 16:10.

P. Blassii, Hort., is a garden hybrid between Bravoa geminiflora and *P. tuberosa*.—*P. gracilis*, Link & Otto (*P. tuberosa* var. *gracilis*, Baker), supposed to be Mexican, is distinguished by slender habit and narrower lvs.: perianth-tube long and slender; segms. linear. Possibly the original form of *P. tuberosa*.—*P. maculata*, Mart., is a Manfreda (p. 1983).

L. H. B.†

Culture of the tuberose for bloom.

There are only two objections to the tuberose: its odor is too powerful for many persons, and, like the calla lily, it has funeral associations. Therefore, fashion has deserted it, at least in North America. Nevertheless great quantities of the bulbs are grown in this

country, and a good part of them are used here as well as exported. The tuberose is more popular than ever in Europe. It will always be a standard florists' flower, for the people like it, whatever fashion may decree.

For the home garden, the bulbs are best procured in spring and planted outdoors after all danger of frost is over. The common tall-growing double sort is preferred for this purpose, largely because the fls. open better during the unfavorable dry weather which often occurs in October. Cover the bulb about an inch with fine light soil. A bulb planted out June 1 will bloom in late summer or fall. Before frost comes, take up the bulbs and store them over winter in a rather warm (50° F.) dry place where no frost will touch them. If kept moist and cool during winter the bulbs are likely to rot at the center. Sound tubers will always be green at top or show some sign of life at the growing-point. The others are not worth planting. In the far North where the season is short, tuberose bulbs may be started indoors about the middle of May, the tubers being placed on a layer of damp moss.

By florists, tuberoses are chiefly grown for summer and fall bloom. It is very difficult to force tuberoses so as to bloom from January to March, but they can be forced with comparative ease to bloom from April to June. Also flowers may readily be secured for November and December by retarding the bulbs.

In forcing, the bulbs are started about the first of January, being placed close together in boxes only 3 inches deep, with 2 inches or so of moss on the bottom. These boxes are placed over the pipe where a temperature of 75° may be maintained. In four to five weeks the tubers will have sent roots all through the moss, and they should then be potted in 4- to 5-inch pots, or planted in a bench containing 4 or 5 inches of soil. The temperature should never be less than 75°, and 80° is better. For May and June bloom, successional batches may be planted at intervals of three or four weeks after New Year. The last crops will usually be the best.

For November florists' bloom the bulbs are retarded in a cool dry place until the middle of August. The second batch should not be planted until about the middle of September. This lot should give good December bloom.

For summer blooming in the open ground for florists, the form known as the "Tall Double" is the most to be preferred. In this variety, the flowers open better and are a clearer and purer white than those of the Pearl. The Albino is a single white tuberose, blooming in July and August. It is a very floriferous variety, with flowers that lack the brown or stained tint of some of the older forms. The odor is less powerful, and therefore more pleasant, than that of the ordinary tuberose. There are several interesting forms.

PETER HENDERSON & Co.

Commercial production of tuberose bulbs.

Tuberose bulbs were formerly grown extensively for commercial purposes in Italy, and are grown in a small way at the present time in South Africa, although the African bulbs are not in much favor with European florists because the bulbs ripen and are shipped in mid-summer and a great number fail to bloom. The foreign-grown bulbs are not imported into the United States and, owing to the superiority of the American-grown tuberoses and the low price at which they are produced, they have driven the Italian-grown bulbs out of the American market. About 80 per cent of the American crop is exported. The larger part of the product of this country is grown in a limited area in the southeastern part of the state of North Carolina, although there has been some falling off in recent years.

Tuberose bulb-culture in the southern states was first attempted by F. A. Newbury in Duplin County, North Carolina, in 1868. Beginning with a dozen bulbs, he propagated stock until, in 1888, the yield was about 1,000,000 bulbs. During these years the crop was cultivated entirely by hand and consequently was very expensive. The prices received at first were \$40 a 1,000, but since then prices have declined each year as quantity increased until, in 1888, bulbs were selling at \$6 to \$8 a 1,000, and in 1915 at \$5 to \$7. In 1888, the late H. E. Newbury, a brother, bought out the business, and he and J. F. Croom, another

grower who had propagated considerable stock, extended the business greatly, introducing less expensive methods of cultivation. By use of the horse-plow they were enabled greatly to reduce the selling price and to stimulate demand for bulbs, so that the crop of 1900, within a radius of 20 miles of one point (Magnolia, North Carolina), amounted to 6,000,000 bulbs, selling at wholesale in carload lots at \$3.50 a 1,000. This yield was secured from over 300 acres. The total yield of the American-grown stock in 1915 was probably about 2,000,000 first-size bulbs.

The crop is set in April, after the soil has been thoroughly pulverized. It is then laid off in rows or furrows 22 inches apart; into these is sown fertilizer at the rate of 600 pounds to the acre. About 400 pounds of cottonseed-meal and 20 bushels of good wood-ashes to the acre have given the best results, although any reliable fertilizer with a good percentage of potash is good. The fertilizer is thoroughly mixed with the soil by running a plow with point only in the furrow. Into this the sets or "seed," as they are called, are carefully placed upright by hand and covered with plow. Usually the bulblets are rather slow in starting off, and just as they begin to break through, the soil, which has become hardened or crusted, is raked or broken up. This assists the plant in getting up and also destroys any growth of grass which may have started. Cultivation is performed chiefly with a cotton-plow, using the sweeps to put earth to the plant and destroying any grass in the rows. Tillage is required every two weeks until August; an occasional hoeing between plants by hand is necessary in order to loosen the soil and destroy weeds and grass not reached by the plow. The crop is matured and gathered between October 15 and November 15. The tops by this time have reached a length of 18 to 20 inches; these are cut off at the ground with a sharp weeding-hoe and the bulbs are plowed out very much as potatoes are. Women then lift out and shake off the earth, and the offsets are removed by hand. These sets are the seed-stock for next season. The bulbs are graded



3093. *Polianthes tuberosa*. ($\times \frac{1}{4}$)

as to size, carried to curing-houses, and by some placed on shelves to dry or cure out. The bulbs must be stirred or have their position changed every few days to prevent mold and rot. This stirring wears or breaks off the roots and tops of a good percentage of the bulbs, making a less sightly bulb, though not injuring its flowering property. The better and more modern way is to gather them by the roots in bunches of about ten, tie them together with a small cord and hang them upon frames, walls, and overhead of house and allow them to cure without disturbing them during the process of drying. While this would seem a rather expensive way, it really costs but a few cents a thousand, being done by small negro children at nominal wages. In recent years, artificial heat of 80° to 100° by means of furnace and flues similar to those used in tobacco-barns has been introduced, to hasten curing. Four to eight weeks are required properly to cure the bulbs for shipping, so that the first shipments begin to move about December 1 to 10. Before shipment the bulbs are again sorted in order to get out any undersized bulbs that may have been overlooked; they are also counted and packed in paper-lined barrels, holding from 700 to 1,300, the number varying with size of bulbs and size of barrels. About 200 barrels, or 150,000 to 175,000 bulbs, constitute a carload. The bulk of the exports go through New York dealers. A few are exported direct.

The variety mostly grown is Dwarf Pearl. This sends up a flowering stem about 15 inches long, the blossom being double. The Tall Double is similar except that the flowering stem is longer, about 24 inches or over. The White or Orange Flower has a long stem, with the blossom single or resembling the blossom of an orange tree. The Albino, a freak from the Pearl, is a dwarf single or orange-flowered variety, but its tendency in other latitudes is to go back to the double type, and consequently is likely to disappoint the grower who expects a single blossom. The foliage of all the above is a rich green. The variegated-leaved variety has a beautiful stripe of golden or silver hue on the outer edge of the foliage. The blossom is single and the habit is dwarf. The tuberose is treated as an annual and has to be replaced each season.

A "number one" bulb (referring to size) is not less than 4 inches in circumference and measures up to 6 inches and over. "Mammoth" bulbs are 6 to 8 inches in circumference; only a very small part of the crop will attain such measurement. A "number two" bulb is less than 4 inches and over 3 inches in circumference, and while in the South these will bloom as well as the larger bulbs they are not much sought by the northern dealers. The tuberose is a rather slow grower; hence in the North, where the frosts are much earlier than in the South, it is likely to get caught before its spike of bloom matures. To succeed in getting flowers in the North they should be started in pots under glass or in rooms free of frost in April and transplanted to open ground in early June. The soil should be deeply pulverized. Choose a sandy loam if possible, and fertilize with manure containing a good percentage of potash. Keep the earth about the plant thoroughly stirred and do not let the plant suffer for moisture.

H. E. NEWBURY.
W. R. NEWBURY.†

POLIOTHYRSIS (Greek, *polios*, white or grayish white and *thyrsos*; referring to the grayish white color of the inflorescence). *Flacourtiaceæ*. A deciduous tree allied to *Idesia* and differing chiefly in the valvate sepals, the 3 styles and in the capsular fr. Fls. monoecious, apetalous, with ovate to lanceolate valvate sepals; staminate fls. with many free short stamens and a minute rudimentary ovary; pistillate fls. with a superior ovary, 3 reflexed styles 2-parted at the apex: fr. a caps. dehiscent into 3-4 valves; seeds many, winged. Similar in habit to *Idesia*, but lvs. longer,

purplish when unfolding; it is apparently of the same hardness, as it has proved hardy in favorable localities at the Arnold Arboretum. Its cult. and prop. is the same as *Idesia*. The only species is *P. sinensis*, Oliver. Slender tree, to 40 ft.: young branchlets pubescent: lvs. long-petioled, ovate to ovate-oblong, acuminate, 5-nerved at the base, dentate, pubescent below or nearly glabrous, 3-7 in., long: fls. in loose terminal panicles 4-8 in. long, greenish white, $\frac{1}{4}$ - $\frac{1}{2}$ in. across; sepals ovate to lanceolate, whitish tomentose outside: caps. $\frac{3}{4}$ in. long, ovate-oblong. Cent. China. July. H.I. 19:1885.

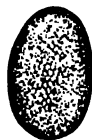
ALFRED REHDER.

POLLEN, POLLINATION. Pollen is the fecundating material contained in the anther, usually in the form of many very small grains. In many orchids it is in the form of masses of cohering parts or grains, termed pollinia. Pollen represents the male or fertilizing phase of reproduction in seed plants. Forms of pollen are shown in Figs. 3094-3097.

All gymnosperms (conifers, and the like) and angiosperms (true flowering or ovary-bearing plants) normally reproduce by means of seeds. For the fertilization of the ovule, in order that seed may result, the intervention of the pollen is necessary. The "dust of the flower" is therefore of far more interest to the horticulturist than this old popular name would imply. Studies in hybridization and self-sterility have long made evident the practical importance of a knowledge of pollen. Every plant provides for the production of this material, and usually in definite pollen-bearing parts termed stamens. The stamens are organs of the flower, and as essential as the carpels. The pollen is produced in definite sacs or compartments of the anther, comprising the tip of the stamens; and when the pollen is ripe, or mature, the fine grains are set free in quantity by the rupture of the inclosing sacs. The abundance of pollen produced may suggest wasteful management of the plant's resources, but a liberal supply of this substance is necessary. Although it requires but a single one of the small grains to fertilize a single ovule and produce a seed, pollen-grains are produced often a thousandfold more abundantly than ovules. The best offspring are usually produced when cross-fertilization occurs, and in the transfer of pollen from plant to plant it is only a small part which can reach its destination. There are many chances and such great losses that abundance of pollen is a necessary provision.



3094. Pollen-grains of *Primula obconica* (below) and *Salvia*. (Magnified)



3095. Pollen-grains of *Browallia*. (Magnified)



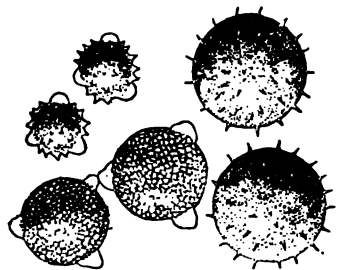
3096. Oddly marked pollen-grain of *Schaeferia flavicoma*. (Magnified)

In general, flowers are pollinated by the wind and by insects; that is, pollen is transported by these two agencies. Flowers principally dependent upon the wind for pollination are termed anemophilous, while those visited by insects are designated entomophilous. These distinguishing terms may also be applied to the pollen itself. Anemophilous pollen is of a more or less spherical form, readily yielding to the wind, and correlated with this is a dry and inadherent outer surface. Such is the case, for example, in the various families to which the oak, willow, grasses, and pine belong, all of which plants are devoid of any stock of brilliant color or rich odors that might attract bug, moth, butterfly, or bee.

The pollen of the pine has even developed bladders, so as to be borne more lightly upon the wind. On the other hand, those plants largely dependent upon the visits of insects for pollination may have the pollen-grains provided with some kind of spines, ridges, furrows, or viscid coatings that they may the more readily adhere to hairy limbs or other surfaces of the insect which may come in contact with them. Here, then, is to be found a reason for the beauty and specialization of external wall. In entomophilous pollen the elliptical form of grain predominates, but the general shape is extremely various; and the plants producing such pollen are usually provided with beauty of flower, fragrance, or other insect attraction.

In order that the pollen which has been transported to the stigma may be effective, it must be healthy. Experiments have shown that weak and poorly nourished orchard trees often produce ineffective pollen. The nature of the season may also have much influence upon its character, continued rains causing great losses by preventing the maturity of this product as well as by mechanical injury and by precluding the winged carriers. Most plants have some special provision for the protection of the pollen against rain; that is, either by the closing of the flower under moist conditions, or by the location of the anthers in a sheltered tube, under projecting hairs, lobes, or other corolla appendages.

The individual particles of pollen are in the form of delicate grains only readily visible in some quantity, as



3097. Pollen-grains of *Abutilon striatum* (above). Bedding geranium (*Pelargonium hortorum*, on right). *Chrysanthemum* (on lower left). (All magnified)

in powdery masses. At the time when they are set free, the grains are generally entirely distinct from one another, to be blown about by an accidental wind or carried by visiting insects. In some cases, however, the grains are bound together loosely or by means of delicate glutinous threads (*Rhododendron*); they may be closely united in fours (heath family); or the whole tissue of an anther or its divisions may remain intact

as pollinia (some orchids, milkweed, and others). A particular species of plant will produce pollen quite constant in form and attire; but an aggregation of cultivated varieties originated from a single species may show considerable variation in this regard. Nevertheless, form, size, color, surface markings, texture of wall, and translucency of contents are not fixed qualities even for related genera or species. See Figs. 3094-3097 for different forms of pollen.

When the healthy pollen of one plant falls upon the ripe stigma of a plant of the same species, the grains germinate in the sugary excretion of the stigma by the protrusion of a tube which penetrates the style and effects fertilization as described under *Fertilization* (Vol. III, page 1221). Furthermore, it is well known that while the flowers of many plants may be readily fertilized by their own pollen, the offspring are stronger when pollen from another plant or another variety has had access to the flower. Sometimes pollen from a foreign variety is absolutely essential to the best fruit-formation. This is particularly true of certain varieties of the pear. A poor quality of fruit can be prevented only by growing together different varieties. Again, although a plant may readily pollinate itself, yet the pollen from another plant or variety may be prepotent over its own. That is to say, if the plant be pollinated by its own pollen along with that of a foreign

variety, that of the foreign variety will usually effect fertilization. This can be explained only on physiological grounds, and at present merely from a theoretical point of view. Any pollen penetrates and effects fertilization because it is attracted, first by substances in the style, and later by the egg-cell itself. When a foreign variety is prepotent it is so because it is more readily attracted, due, we may say, to a greater difference of potential between the two elements, the two elements from the same plant being more in equilibrium and less markedly attractive. As regards pollen from a foreign species, it seems to be the rule that hybridization does not occur so readily, and we must then assume that the differences have become so great as to cause repulsion.

The detailed development of pollen is highly interesting and instructive on morphological grounds, but in this place a very brief account of the formation of the grains will suffice. The developmental phases in *Bigonia* (*Pyrostegia*) *venusta* will serve as an example. A cross-section of the young flower-bud will show that in the anther-sac regions, semicircular layers of large well-nourished cells (called archesporial cells) are differentiated. These cells divide and the layer increases in extent, yet in this case it is always only one cell in thickness. When these cells have finally attained considerable size and provided themselves with a thick wall, they divide more or less simultaneously; and then each of these daughter-cells divides again by a division following quickly upon the first. Each cell has then formed four new cells within its original walls. The new cells remain thus united in fours until each is provided with a stout wall of its own, and then they separate. Each cell is then an immature pollen-grain, and technically a spore, that is, exactly homologous with the microspores of the vascular cryptogams. As a rule, before these pollen-grains are set free, another change occurs denoting maturity. This consists in the division of the nucleus of the spore in such a way that two cells of unequal size result (in some conifers several small cells are formed). On germination the large cell, which now incloses the smaller, protrudes the tube which penetrates the style; whereas the nucleus of the small cell divides into two, and one of these fuses with the egg-cell in the ovule, thus fertilizing it.

B. M. DUGGAR.

Pollination.

In botanical usage, pollination is the transfer of pollen from the anther to the stigma. In horticultural usage, particularly with reference to orchard fruits, the term is often applied in a general way to designate all the influences concerned in the setting of fruit. For the benefit of those who are uninformed in botany it may be said that pollination is concerned primarily with the "essential organs" of the flower,—the stamens and pistils. The stamens bear the pollen in their anthers, and they die after the pollen is shed. The pistils bear the ovary or seed-case, the style, and the stigma. The pollen falls upon the stigma. In some plants these organs are separated in different flowers or even on different plants. (Fig. 3098.)

Aside from those cases in which the stamens and pistils are so intimately associated that the pollen falls directly upon the stigma, flowers are pollinated mainly in two ways: by wind and by insects. The grasses, sedges, and pines are examples of wind-pollinated plants. The flowers of wind-pollinated plants are usually inconspicuous and without nectar or fragrance. They produce a great abundance of light dry pollen, which is wafted away by the slightest breeze and is often carried many miles by a strong wind. The pistils of these plants are long and feathery, and thus are well adapted to catch flying pollen.

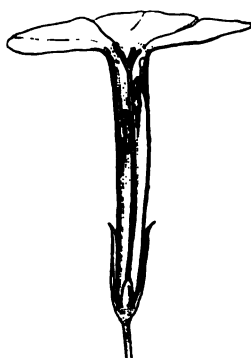
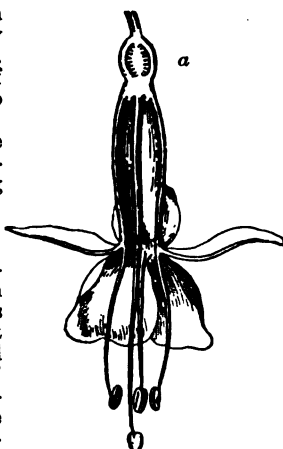
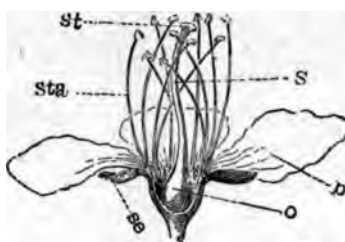
The flowers of insect-pollinated plants, on the other hand, are usually showy, and have nectar or fragrance,

or both. The pollen is more or less moist or sticky, so that it is not easily blown away. Insects are probably attracted by the showy colors and by the perfume, both of which bespeak the presence of nectar. As the insect reaches down for the nectar, which is near the bottom of the flower, some parts of its body are almost sure to become dusted with pollen. When the insect visits another flower some of this pollen may be brushed upon the stigma and a fresh supply received. This pollen likewise may be carried to another flower, and so on. Thus cross-pollination, or the transfer of pollen from the anthers of one flower to the pistil of another, is accomplished.

Many flowers, notably the orchids, have special modifications of structure apparently developed for the purpose of securing cross-pollination by insects and preventing self-pollination. The bodies of some insects, also, have corresponding adaptations which insure the cross-pollination of certain flowers which they are in the habit of visiting most frequently. This correlation between flowers and their insect visitors has been the subject of extended observation. "Fertilization of Flowers," by Herman Müller, contains a bibliography of the subject up to 1886. For the distinction between fertilization and pollination, see the article *Fertilization*, page 1221.

The value of crossing to plants was first clearly proved by Charles Darwin in 1859. From the observations of Kolreuter, Sprengel, Knight, and his own exhaustive experiments, Darwin showed that continued self-fertilization is likely to result in inferior offspring; while cross-fertilization, within certain limits, gives greater vigor to the offspring. Cross-fertilization between different flowers on the same plant usually has no appreciable advantage. The probable reason for this is that the plant resulting from the union of unlike parents, as in cross-fertilization between flowers on different plants, is more variable than one resulting from self-fertilization or crossing between different flowers on the same plant, and hence has a better chance of fitting into new conditions.

Plants are endlessly modified to secure cross-fertilization and avoid self-fertilization. The principal means by which this end is gained are: (1) Special contrivances in the structure of the flower which favor cross-pollination. (2) A difference in the time at which the pollen matures and the stigmas become receptive in the same flower (dichogamy). This condition is very noticeable in some varieties of orchard fruits. The prematurity of the pistil is more common than the prematurity of the stamens. (3) Self-sterility, which is the inability of a flower to set fruit with its own pollen. Self-sterility is not usually due to a deficiency of pollen or to defective pistils. The pollen-grains often germinate on the stigma, but fertilization does not take place. The embryological reasons for this are not clearly understood. The ultimate cause of self-sterility in the grape



3098. Structure of the flower, to illustrate pollination.

1. Top.—The structure of a plum blossom: *se*, sepals; *p*, petals; *sta*, stamens; *o*, ovary; *s*, style; *st*, stigma. The pistil is composed of the ovary, style, and stigma. It contains the female part. The stamens are tipped with anthers in which the pollen, or male part, is borne. The ovary, *o*, ripens into the fruit.

2. Fuchsia, showing ovary at *a*, 3 stamens (one is removed) and the projecting style.

3. Buttercup, showing many small pistils in the center and stamens surrounding them.

4. Bottom.—Phlox, showing the 3-parted stigma, and the stamens included in the tube.

has been studied by Dorsey. Cytological studies of the pollen of self-sterile varieties showed distinct degenerative processes in the generative nucleus, or arrested development previous to mitosis in the microspore nucleus. Dorsey concludes that self-sterility in the grape is not due to hybridity alone, as suggested by Beach, since there are both fertile and sterile hybrid varieties; but is due also to deep-seated influences operating to produce declinism and dioeciousness, the native species of grapes being mostly dioecious. Dorsey finds the nuclei of the pollen of many self-sterile varieties of native plums to be degenerated and disorganized. Degeneration of the pollen cannot be the main cause of self-sterility, however, since two self-sterile varieties may be mutually fruitful when planted together. About sixty species of plants are known to be more or less self-sterile. (4) The separation of the sexes in different flowers or on different individuals. It is thought by some that there is a gradual evolution among some kinds of plants toward unisexuality, and that adaptations for insect-pollination, dichogamy, and self-sterility are steps in this process.

Self-sterility has an important economic aspect in the culture of certain fruits. It is common in varieties of pears, apples, plums, and grapes; it is uncommon or unknown in cherries, peaches, raspberries, currants, gooseberries, and strawberries. Whenever isolated trees or large blocks of a variety blossom full year after year, but drop most of the fruit before it is half-grown, the variety may be self-sterile, provided the failure cannot be attributed to excessive vegetative vigor, marked lack of vigor, disease (especially scab, brown-rot, and fire blight), insect attack, unfavorable weather during the blossoming season, or other untoward circumstance. Self-sterile varieties are detected experimentally by inclosing the unopened blossoms in thin paper sacks, and dusting the pistils, when receptive, with the pollen produced by these blossoms; or by emasculating them and hand-crossing with pollen of the same variety. If very few fruits are produced from a large number of these selfed blossoms, but the variety fruits abundantly when crossed with other sorts, it is self-sterile. A few varieties of fruits are more or less self-fruitful, as distinct from self-sterile; they bear good fruit with their own pollen, but the fruits are seedless, as in the banana. Ewert found that many apples in Germany have this parthenocarpic development; that is, they grow without fertilization. It is not common in North American varieties of fruits.

Self-sterility is not a constant factor in any variety. It appears to be almost as easily influenced by the conditions under which the plant is grown as is the shape or color of the fruit. A variety is frequently self-sterile in one locality and self-fertile in another. Waite found several varieties of Japanese plums self-sterile, but concluded, "With plums, as

with other fruits, self-sterility is purely relative; under favorable conditions these varieties are able to set fruit without cross-pollination." Powell proved that in different parts of the Delaware-Maryland peninsula the Kieffer pear is self-sterile, partially self-fertile, or completely self-fertile. The Ben Davis apple is self-sterile in Vermont, according to Waugh, but self-fertile in Kansas, in the experiments of Greene. Bartlett pear is self-sterile in most of the Atlantic States, but usually self-fertile on the Pacific Coast. Beach found that varieties of grapes which are weakly self-fertile vary in this respect in different localities, and even in different parts of the same vineyard, being entirely self-fertile in one place and completely self-sterile in another. It is quite evident that the degree of adaptation of a variety to its environment of soil and climate has much to do with its ability to fruit abundantly with its own pollen.

It is not possible, therefore, to give a list of varieties that are self-sterile, and another list of those that are self-fertile, that would have more than local application. There are certain sorts, however, that are less dependable in this respect than others. Out of eighty-seven varieties of apples tested in Oregon by Lewis, fifty-nine were self-sterile, fifteen self-fertile, and thirteen partially self-fertile. Powell found practically all the commercial varieties of apples in Delaware self-sterile, except several summer sorts. Some of the prominent commercial varieties that are usually more or less uncertain are: Arkansas (Mammoth Black Twig), Gravenstein, Grimes, Jonathan, King (of Tompkins), Limbertwig, Paragon, Northern Spy, Ortley, Rome, Spitzenburg (Esopus), Twenty Ounce, Winesap. Among those generally quite dependable are Ben Davis, Baldwin, Oldenburg, Rhode Island Greening, Yellow Transparent, Yellow Newtown.

Anjou, Bartlett, Clairegaul, Clapp, Howell, Kieffer, Lawrence, Nelis, and Sheldon pears are frequently uncertain, while Angouleme (Duchess), Bosc, Flemish, and Seckel are usually self-fertile. Practically all the varieties of Japanese and native plums are self-sterile, the single exception, according to Waugh, being Robinson. Wild Goose and Miner are notoriously infertile. Hooper and Backhouse report that the European varieties are largely self-sterile in England, but in America the defection is confined chiefly to Coc, French Prune, and Italian Prune. The experiments of Close, Whitten, and Howard, indicate that all the leading varieties of peaches are self-fertile, and are not benefited by cross-pollination. In Germany, however, Ewart finds peaches "sparingly self-sterile." No cherries are known to be self-sterile, although Napolcon, Belle de Choisy, and Reine Hortense have that reputation among commercial growers.

Of one hundred and forty-five varieties of grapes tested by Beach, thirty-one were self-fertile, forty-one self-sterile, and seventy-three uncertain. Brighton, Herbert, Lindley, Merrimac, Salem, Wilder, and other hybrid varieties are decidedly unfruitful with their own pollen; while Concord, Delaware, Diamond, Niagara, Winchell, and Worden are among those strongly self-fertile. Reimer found the Scuppernong and other varieties of the Muscadine grape so defective in pollen that they are fruitful only when planted near male vines of the Muscadine. No varieties of the quince, raspberry, currant, gooseberry, or strawberry have been found self-sterile, but many varieties of strawberries lack well-developed stamens and so must be planted near perfect-flowered sorts.

A self-sterile variety often may be made fruitful by planting near it another variety to supply pollen; or by top-grafting part of the tree with cions of another sort. No benefit is derived from other trees of the same variety, even if brought from a distance, since all are but divisions of the same original seedling. In the selection of a pollinizer, several points must be con-

sidered: (1) The two sorts must blossom approximately at the same time in order that cross-pollination may be possible. The transfer of pollen from one variety to another is performed mainly by insects. Waugh and Backhouse have shown that practically none of the pollen of the plum and other stone-fruits is carried by wind, it being moist and sticky. The same is true of pears, but apple pollen is somewhat drier and is wind-blown to a slight extent. The honey-bee is the most important pollen-carrier. Hooper estimates that in England 80 per cent of the cross-pollination is done by the hive bee, 15 per cent by various wild bees, especially the bumblebee, and 5 per cent by miscellaneous insects. In tree-fruits it is necessary to select varieties that come into bearing at about the same age, otherwise one might be without cross-pollination for the first two or three years. Several state experiment stations have published lists of varieties blossoming at the same time, for the guidance of the planter. See New York (Geneva) Bulletin No. 407. (2) There should be an affinity between the two varieties, so that the self-sterile sort may find the pollen of the other acceptable. This can be determined only by hand-crossing. Beach found that the pollen of self-sterile varieties of grapes is practically incapable of fertilizing other varieties; but this does not hold for tree-fruits since two self-sterile varieties planted together usually are mutually fruitful. Powell found no affinity between Paragon and Stayman apples; Kerr none between Wild Goose and Whitaker plums, and there are a number of other instances. Undoubtedly some varieties are more acceptable as pollinizers of a self-sterile variety than others. Spitzenburg apples produced by Lewis from Jonathan pollen averaged 144 grams in weight; from Baldwin pollen, 157 grams. In general, however, varieties of the same species that blossom simultaneously cross-fertilize readily, and there is no appreciable and constant difference in the fruit. (3) In commercial orchards the pollinizer should be a standard variety, valuable for market. (4) It should produce a large amount of pollen. Winesap produces little pollen; it would be unsatisfactory as a pollinizer for other sorts; Grimes, Ben Davis, and Rome are abundant pollen-bearers.

Cross-pollinated fruits may be larger and heavier than self-pollinated fruits, but there is rarely any other influence. The shape, color, flavor, and keeping quality remain the same, regardless of the variety selected as a pollinizer. Kieffer pears pollinated with Seckel look and taste no different from Kieffer pears pollinated with Le Conte. Many supposed instances of the immediate influence of pollen have been recorded, but in most cases proof is lacking that the changes were not due to bud-variation. It cannot be doubted that this influence is exerted occasionally, but certainly much less frequently than is commonly supposed.

In small orchards there is no need of mixing the varieties with special reference to cross-pollination. In orchards covering more than 10 acres, it is desirable to intersperse the varieties at regular intervals. It is more convenient in spraying, harvesting, and other orchard operations to plant the pollinizer in a solid row instead of mixing it in the rows with the self-sterile sort. If the pollinizer is not very valuable, one row in ten may be sufficient; but usually one in four to six is safer. If the pollinizer is a valuable variety, the two should be alternated in blocks of four to six rows each. It is not necessary to plant more than one variety as a pollinizer.

Orchard pollination, however, is a broader problem than the mere detection of varieties that are inclined to be unfruitful when planted alone, and discovering which are the best pollinizers for each of them. Experiments in crossing and observations in orchards indicate that nearly all varieties, whether self-sterile or self-fertile, will produce more or better fruit with foreign pollen than with their own. Powell found that some self-sterile trees of Kieffer in Delaware bore a light crop.

with their own pollen, 4 per cent of the self-pollinated blossoms producing fruit; but bore a much heavier crop when pollinated with Duchess, Lawrence, and other varieties, 76 per cent of the crossed blossoms producing fruit. Yellow Newtown is distinctly self-fertile in Oregon, yet Lewis noted a decided improvement in the fruit when Jonathan and Grimes pollen was used upon it. He concluded, "All varieties of pome-fruits, at least of apples and pears, even though they may be termed self-fertile, are benefited by having other varieties planted with them as pollenizers." The benefit will usually more than offset the slight inconvenience in orchard management occasioned by this mixed planting. The chief economic problem for the experimenter, therefore, is to determine what commercial varieties may be planted together for best results; and the rational course for the fruit-grower is to practise mixed planting on the basis of these experiments.

Those who wish to study the subject of fruit-pollination in greater detail should consult the following publications: Vermont Experiment Station Reports, 1896-1900; Delaware Experiment Station Reports, 1900-1902; Oregon Experiment Station Bulletin No. 104, Circular No. 20, Research Bulletin No. 1; New York (Geneva) Experiment Station Reports, 1892-1895; Bulletins Nos. 153, 157, 169, 223; Wisconsin Experiment Station Reports, 1894-1896; New York (Cornell) Experiment Station Bulletin No. 181; North Carolina State Experiment Station Bulletins Nos. 201, 209; United States Department of Agriculture, Division of Vegetable Pathology, Bulletin No. 5; Minnesota Experiment Station Bulletin No. 144; Missouri Experiment Station Bulletin No. 117; Virginia Experiment Station Report 1909-1910.

S. W. FLETCHER.

PÓLLIA (named after van der Poll). *Commelinaceae*. Perennial herbs: sts. ascending from a creeping base or often erect, sometimes stout: lvs. very large: infl. terminal panicles either lax thyrsoid, or short and dense; sepals 3, persistent; petals 3, small, obovate, white or pale rose; stamens 6 or 3 and 3 staminodes; ovary 3-celled, 2- to many-seeded: fr. a globose or ellipsoid indehiscent caps.—About 18 species in Afr., India, Malaya, E. Asia, the Philippines, and Austral. *P. condensata*, C. B. Clarke. Nearly glabrous: sts. 2-6 ft. long, thick: lvs. 12 x 3 in., lanceolate-obovate, acuminate at either end: panicle 20-40 fld., dense; stamens 3, fertile. Trop. Afr. Var. *variegata*, Hort., differs from the type in having the long dark green, oblong-lanceolate lvs. variegated with yellowish white. Trop. Afr. R. B. 34:407.—Grown for ornament.

POLYANTHUS. In common speech Polyanthus means the florists' flower supposed to be derived chiefly from *Primula elatior* or its allies. The "Polyanthus Narcissus" of trade catalogues is one of the forms of *Narcissus Tazetta*, an old synonym of which was *Narcissus Polyanthos*. Polyanthus may also mean the tuberose, *Polianthes*, which see. There is no genus known as Polyanthus.

POLYBÖTRYA (Greek, *many* and *grapes*; referring to the massed sporangia). *Polypodiaceae*. A small group of tropical ferns somewhat related to *Dryopteris*, but characterized by having the sporangia massed and covering the entire under side of the fertile lvs. as in *Acrostichum*, to which the species have been referred: lvs. 1-4 times pinnate, the fertile lvs. reduced so in tissue that they consist of little more than lf-skeletons, affording space for the production of the sporangia.

osmundacea, HBK. Rootstock wide, climbing, with long, linear scales: sterile lvs. 2-3 ft. long, the lower pinnæ 8-10 in. long, with numerous slightly stalked segms., veins free; fertile lvs. tripinnate, with the lower pinnæ 1-2 ft. long, 4-8 in. wide, with narrow, cylindric

segms. $\frac{1}{4}$ - $\frac{3}{4}$ in. long. W. Indies to Brasil.—Probably the handsomest of the climbing kinds. Another cult. species sometimes included in this genus is designated here *Olfersia cervina* (*Acrostichum cervinum*), which see.

R. C. BENEDICT.

POLYCALYPTA: *Myriocephalus*.

POLYCYNIS (Greek, *many* and *swan*, probably referring to the lip and column which together bear some resemblance to a swan). *Orchidaceae*. Epiphytic herbs with very short vaginate 1-lvd. sts., scarcely thickened to a fleshy pseudobulb: lf. broad, plicate-veined, contracted to the petiole: scapes erect from the rhizome, few-sheathed; fls. rather large, pedicelled; sepals subequal, free, spreading, narrow; petals similar to the sepals or at the base narrower and substipitate, labellum affixed to the base of the column, spreading, sometimes 2-auricled at the base, column elongated, slender: fr. a caps.—About 7 species in Trop. Amer. *P. Charlesworthii*, Hort. Infl. long and arching, bearing about 50 fls. which are 1 in. across; sepals broad, yellowish, closely mottled with pale red-brown, the upper abruptly turned back; petals linear, twisted, yellow, slightly marked with red at the base; lip long, narrow, brownish with whitish hairs. British Guiana. Intro. abroad and offered for sale there. The following species may have been cult.: *P. barbata*, Reichb. f. (*Cynodes barbatum*, Lindl.); *P. gratiosa*, Endres & Reichb. f.; *P. lepida*, Lind. & Reichb. f.; *P. muscifera*, Reichb. f. (*Cynodes musciferum*, Lindl. & Paxt.); and *P. vittata*, Reichb. f. (*Houlletia vittata*, Lindl.). Warmhouse plants.

F. TRACY HUBBARD.

POLYGALA (Greek, *much milk*; from the old idea that some species increased the flow of milk). *Polygalaceae*. MILKWEED. Annual or perennial herbs, subshrubs, shrubs or very seldom trees, sometimes planted in the open or some kinds raised under glass for the bloom.

Leaves alternate or rarely opposite or verticillate, with or without stipules: infl. racemes or spikes, terminal, lateral, or forked, rarely axillary; fls. showy or



3099. *Polygala paucifolia*. (X $\frac{3}{4}$)

small, colors various; calyx with very dissimilar sepals, the lateral (inner) pair larger; petals rarely 5, usually reduced to 3; stamens 8; ovary 2-celled: fr. a compressed 2-celled wing-margined or wingless caps.—About 550 species scattered through the temperate and subtropical regions of the world and a few species in the tropics.

Polygalas from a cultural standpoint may be grouped as hardy and tender species and the latter are sometimes cultivated under glass, frequently outdoors in the South, as in southern California. There are about

forty North American species but only a few of them have been offered by dealers in native plants. The hardy species should be grown in rather light soil, but they require some moisture and are best adapted to partially shaded positions. They may be raised from seed sown in the fall or early spring. The more commonly cultivated species are the exotic ones, especially the shrubby Cape kinds which grow from 2 to 4 feet or more high, bearing subterminal racemes of large flowers.

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A. Plants hardy.

B. *Fls. showy*, $\frac{1}{2}$ – $\frac{3}{4}$ in. long.

C. *Keel beautifully fringed*.

1. *paucifolia*, Willd. FLOWERING WINTERGREEN. GAYWINGS. FRINGED MILKWORT. FRINGED POLYGALA. Fig. 3099. Trailer, 3–6 in. high: upper lvs. clustered, ovate, $1\frac{1}{2}$ in. long; lower lvs. distant, small, and becoming mere bracts at the base: fls. bright rosy purple, varying to white, 1–4 in the axils of the upper lvs. or appearing terminal. May, June. New Bruns. to Winnipeg, and Ga. Prefers moist woods and sphagnum bogs. B.M. 2852 (petals white). B.B. 2:361. Var. *alba* was once offered by a Mass. dealer in hardy plants, where it grows wild. One sometimes finds violet-fl. forms. The species bears cleistogamous fls.

cc. *Keel merely 4-lobed*.

2. *Chamaebuxus*, Linn. BOX-LEAVED MILKWORT. Evergreen trailer: upper lvs. lanceolate or elliptical, mucronate; lower lvs. smaller, obovate: peduncles axillary and terminal, about 2-fl.; fls. as many as 10 on a stalk, typically yellow, more or less reddish toward the end of the keel; stamens united only at the base. April–June. Eu., low heaths and woods to highest Alps. L.B. C. 6:593. B.M. 316 (wings white: petals white at base, yellow or red at tip). Var. *grandiflora*, Gaudin (var. *purpurea*, Neir.), has purple wings, set off by yellow petals. Gn. 13:36; 30:148 (charming: wings rosy pink).

BB. *Fls. not showy*.

C. *Infl. a spike; fls. not pedicelled*.

3. *Senega*, Linn. SENECA SNAKE-ROOT. MOUNTAIN FLAX. Fig. 3100. Height 1 ft. or less: lvs. 1–2 in. long: fls. white or greenish, $1\frac{1}{2}$ lines long; crest small, few-lobed. May, June. Rocky woods, New Bruns. to Rockies, south to N. C. to Mo. B.B. 2:360. L.B.C. 14:1380. B.M. 1051. — Bears no underground fls. Root used in medicine.



3100. *Polygala Senega*. ($\times \frac{1}{2}$)

cc. *Infl. a raceme; fls. pedicelled*.

4. *polygama*, Walt. Height 1 ft. or less: lvs. 1 in. or less long: fls. purple or rose, rarely nearly white, 2–3 lines long; crest relatively large, lacinate. June, July. Dry soil, Nova Scotia to Lake of the Woods, S. Fla. to Texas. B.B. 2:360. — Bears numerous underground fls.

AA. *Plants tender*.

B. *Habit shrubby, erect, 2–3 ft. high or more*.

C. *Lvs. opposite*.

5. *oppositifolia*, Linn. Probably the only species in the genus with opposite lvs.; an abnormal feature in the whole family. Tall slender shrub: racemes few-fl.; fls. large, purplish. S. Afr. B.M. 492. B.R. 636. — Harvey gives 8 botanical varieties, of which probably the commonest in cult. is var. *cordata*, Harv. (*P. cordifolia*, Thunb., not Presl. *P. oppositifolia* var. *major*, Lindl. *P. oppositifolia cordifolia*, Voss). Glabrous or downy: lvs. broadly cordate, acute or acuminate: fls. bright purple-red or purple-violet. B.M. 2438. B.R. 1146. L.B.C. 12:1189. Var. *latifolia*, Ker (*P. grandis*, Hort.). Lvs. heart-shaped, acute, smooth: fls. large, beautiful purple-violet, bearded.

cc. *Lvs. alternate*.

D. *Lateral petals 2-cut*.

6. *myrtifolia*, Linn. Readily told from *P. virgata*, its infl. being a few-fl., leafy raceme, while that of *P. virgata* is many-fl. and leafless. Densely branched shrub, 3–8 ft. high, with large, showy fls. near the ends of the branches: lvs. flat, variable in shape, but not subulate: lateral petals 2-lobed, the posterior lobe ear-shaped, reflexed. S. Afr. Var. *grandiflora*, Hook. (*P. grandiflora*, Hort., and L.B.C. 13:1227, not Walt. *P. longiflora*, Dietr.). Fls. over 1 in. long. B.M. 3616. B.R. 669. G.W. 10, p. 629.

7. *Dalmaisia*, Hort. (*P. myrtifolia* var. *Dalmaisia*, Hort.), also often wrongly offered in the trade as *P. dalmacina* and *P. dalmatiana*. It resembles *P. myrtifolia* var. *grandiflora* very closely: lvs. rather tending to be alternate, sessile, rather glaucous as in *P. myrtifolia*: fls. in terminal racemes, rather large, purple or rosy magenta with the base of the keel whitened or almost white. R.H. 1844:193. Gt. 5:161. R.B. 25:145. G.W. 8, p. 316. — *P. Dalmaisia* is said to be a hybrid *P. myrtifolia* var. *grandiflora* (*P. grandiflora*) crossed by *P. oppositifolia* var. *cordata* (*P. cordifolia*). The pictures show some slight verification of this, but many authorities treat the plant as a variety of *P. myrtifolia*; this species and its varieties are very commonly cult. in Calif., particularly the one known in gardens as *P. dalmacina* or *P. dalmatiana*; this flowers all the time and is very popular. The popularity of *P. Dalmaisia* in Calif. is an example of the persistence of a good thing in gardens, though almost unknown to botanists. The spelling *dalmatiana* shows that some gardeners have thought the name a geographical one. The plant was named after M. Dalmais, a French gardener, who raised it from seed in 1839. As known in the trade, *P. Dalmaisia* is a free-blooming plant with rosy or purplish fls. It goes under three or four names. It makes a good pot-plant, but is somewhat bare of foliage. It blooms from the ends of the ripened growth. It can be had in flower almost any time. The odd color and shape of the fls., and its free blooming, make it very attractive. It roots only fairly well from cuttings. Usually it propagates better by layering. Put in rich loam with well-rotted manure. It will stand considerable frost.

DD. *Lateral petals not 2-cut*.

8. *virgata*, Thunb. Glabrous shrub, 2–5 or even 15 ft. high, with rod-like branches terminating in many-fl., leafless racemes of purple or flesh-colored fls.: anterior sepals distinct; wings obtuse. S. Afr. — The

typical form is advertised in S. Calif., but in Eu. probably the only form cult. is var. *speciosa*, Harv. (*P. speciosa*, Sims). Glabrous: lower lvs. obovate or cuneate, upper more linear, all obtuse: raceme long and lax: bracts soon deciduous. S. Afr. B.M. 1780. L.B.C. 7:621. B.R. 150. B. 1:43.

9. *apopétala*, T. S. Brandeg. Frutescent, 2-3 ft. high: branches slender, pubescent: lvs. lanceolate, entire, obtuse, alternate, remote, short-petioled, nearly glabrous: fls. large, pink, on slender pedicels $\frac{1}{2}$ in. or more long; sepals 4, the upper and lower small, equal, cymbiform, margins ciliate, the lateral very large, nearly orbicular; petals 5, separate, upper strap-shaped, two-thirds as long as keel, lateral pointed, less than one-half as long, embraced with the 8 stamens by the large cymbiform keel, which is opened on the upper and lower edge and not cristate, or appendaged: seeds 2, large, ovoid, pubescent. Low. Calif. B.M. 8065.—In S. Calif. *P. apopétala* is said to grow up to 15 ft. or more in height and to be valuable economically as its young branches contain a very strong fiber and the pea-sized brown seeds which are plentifully produced yield as much as 38 per cent of excellent oil. The root has the same properties in a higher percentage as are contained in *P. Senega*.

BB. *Habit dwarf, 1 ft. or less high.*

10. *amatymbica*, Eckl. & Zeyn. (*P. acuminata*, E. Mey. & Hort.?, not Willd.). Densely tufted, erect, 3-6 in. high: lvs. lanceolate-acuminate, pungently mucronate: racemes lateral, few-flid., spreading or reflexed; fls. small, wings green, keel and petals flesh-color to purple; keel with a many-parted crest. S. Afr.—*P. acuminata* of the trade is probably not *P. acuminata*, Willd., which is *Badiera acuminata*. *Badiera* differs from *Polygala* in having 2 of the sepals only a little larger than the others, instead of much larger.

Two other species have been recently intro. into cult.: *P. brachypoda*, Tod., whose native country is not known, has erect growth, green very straight branches, long and very narrow lvs., and numerous reddish purple fls. Intro. into Calif.—*P. Vayredae*, Costa. A small plant 4 in. high, hardy or half-hardy in England, growing only a few inches high, with linear, evergreen lvs. and reddish purple fls. with a yellow keel. Spain. Closely resembles *P. Chamaebuxus*, but has narrower lvs.

WILHELM MILLER.

F. TRACY HUBBARD.†

POLYGONATUM (Greek, *many knee*; alluding to the numerous joints of the rootstock). *Liliaceæ*. SOLOMON'S SEAL. Perennial herbs, with simple stems from creeping knotted rootstocks, sometimes planted.

Stems naked below, above bearing nearly sessile or half-clasping nerved lvs. and axillary nodding greenish fls.: perianth cylindrical, 6-lobed at the summit; stamens 6; ovary 3-celled with 2-6 ovules in each cell: berry globular, black or blue.—About 60 species, widely distributed in the temperate regions of the northern hemisphere. The genus is distinguished from its nearest allies by the cylindrical perianth-tube with short lobes and small undivided style. *Polygonatums* are graceful in their habit, the unbranched arching sts. bearing pendulous, tubular fls. 1-10 in the axils. The name Solomon's seal is connected with the horizontal rootstocks which are scarred by the death of the annual stems, each scar being likened to a seal (see *Smilacina*).

Polygonatums are best suited for partially or wholly shaded positions, although they do well in the open in a well-prepared border. They like a deep rich soil not subject to drought. Easily propagated by division. They are among the best subjects for wild gardening. *P. multiflorum* is used abroad considerably for forcing and for house plants. Our native species are presumably equally desirable for all purposes. The Solomon's seal of English literature is *P. multiflorum*, which is probably the commonest species native to Europe. There are several Himalayan and Japanese species. The common Solomon's seal of our nurseries is the European, *P. multiflorum*, the American kinds being listed only by

specialists in native plants. The others here described are offered by Dutch bulb-growers. For extended articles on the forcing of *P. multiflorum*, see Gn. 26, p. 236 (or V. 7:337); 30, p. 49, and F.R. 3:594.

A. *Lvs. all whorled.*

verticillatum, All. St. 2-3 ft. high: lvs. in whorls of 4-8, linear, 3-6 in. long: fls. in 2's or 3's. Eu., Himalayas.—*P. macrophyllum*, Link, is perhaps a distinct variety with more robust habit and larger lvs.



3101. *Polygonatum biflorum*. ($\times \frac{1}{2}$)

AA. *Lvs. alternate.*

B. *Perianth 2-3 lines thick.*

officinale, All. Height 1-1½ ft.: fls. 1 or 2 in the axils: lvs. oblong, 2-3 in. long, firmer than those of *P. multiflorum*: perianth-segms. greenish. Eu., Siberia.—*P. ambiguum*, Link, is offered as a distinct form abroad.

latifolium, Desf. (*P. Thunbergii*, C. Morr.). Height 2-4 ft.: fls. 1-5 in the axils: lvs. oblong, 3-6 in. long: perianth-segm. greenish. Eu., Asia.—Intermediate in habit between *P. officinale* and *P. multiflorum*, but with earlier fls.

BB. *Perianth 1½-2 lines thick.*

c. *Plant glabrous.*

multiflorum, All. Height 2-3 ft.: lvs. oblong, 3-6 in. long: perianth-tube white; segms. greenish; filaments densely pilose. Eu., N. Asia, Himalayas. Gn. 26, p. 236; 30, p. 49; 69, p. 172. V. 7:337. Var. *florido-seo*, Hort., has rosy fls.—There are said to be varieties with double fls. and variegated foliage. The type seems to be more graceful than the varieties. This is the common Solomon's seal of Eu., where it is also called lady's seal and David's harp.

commutatum, Dietr. (*P. giganteum*, Dietr.). Taller and more robust than *P. biflorum*, 1-8 ft. high: lvs. 1½-6 in. long, 3-4 in. wide: fls. 1-8 in the axils; filaments somewhat flattened, smooth, not roughened.

May-July. Moist woods, N. H. to Man., S. Ga., La. to New Mex. and Utah.

cc. *Plant with lvs. pubescent beneath.*

biflorum, Ell. Fig. 3101. Height 8 in. to 3 ft.: lvs. 2-4 in. long, $\frac{1}{2}$ -2 in. wide: fls. often 2 in axils, sometimes 1-4. April-July. Woods, New Bruns. to Mich., south to Fla. Mn. 8:49.

P. intermedium as offered in the European trade is presumably *P. intermedium*, Dum., which is commonly considered nothing more than a form of *P. multiflorum*, All.—*P. macdonatum* of foreign trade-lists is botanically unknown. The plant offered in the American trade as *P. majus* is not known botanically, but it is said to grow 3 ft. high and bear pendent creamy fls. in May and June.

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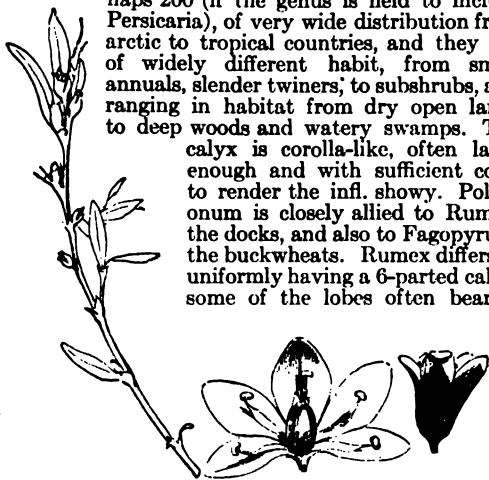
POLYGONELLA (diminutive of Polygonum). *Polygonaceæ*. About 7 species of American plants closely allied to Polygonum and of no horticultural standing, although one or two names may appear in the trade. *P. polygama* was offered in Mass. in 1881, but it is probably not hardy N. The genus differs from Polygonum in having only the inner sepals erect and the calyx enlarged in fr., while in Polygonum all the sepals are erect and the calyx is not enlarged in fr.

polygama, Gray (*P. parvifolia*, Michx.). Diffuse shrub: lvs. wedge-shaped, vertical, those on sterile shoots imbricated: racemes $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, very numerous, in an oblong or corymbose panicle; fls. white, yellowish or rose-color; filaments all alike; stigmas nearly sessile. Aug., Sept. Dry sandy soil, Fla. to N. C.

americana, Small (*P. ericoides*, Engelm. & Gray. *Gonopodium americanum*, Fisch. & Mey.). Perennial, frutescent: lvs. linear, persisting: racemes dense, divergent; calyx white or pink; pedicels divergent, jointed below the middle: achene elliptic-oblong, chestnut-brown. Dry soil, Mo. to Texas, east to Ga. and Ala.

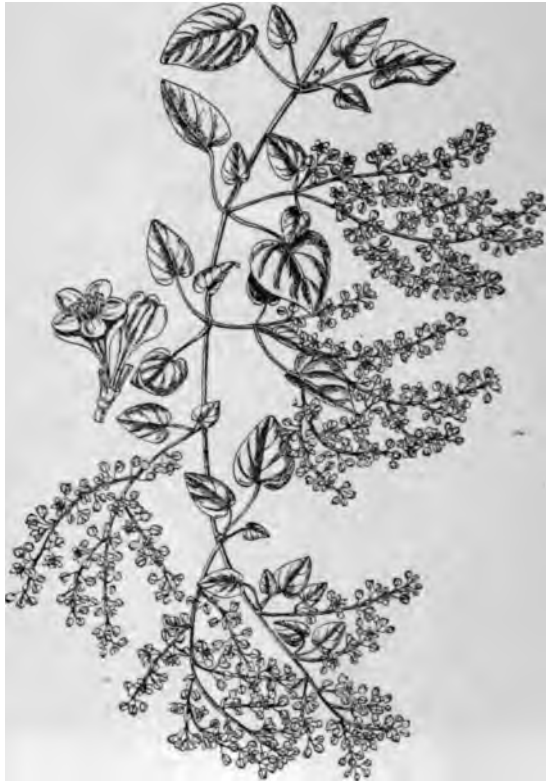
POLYGONUM (Greek for *many-jointed*). Including *Persicaria*, *Bistorta*, *Tofora*. *Polygonaceæ*. JOINTWEED. KNOTWEED. SMARTWEED. Erect or twining plants, grown for ornament, the flowers and foliage often attractive.

Mostly herbs, annual or perennial, with small fls. on jointed pedicels in racemes, spikes or heads (sometimes solitary): lvs. alternate, simple, jointed to an ocrea or sheath which clasps or surrounds the st. and may at length split and become indistinct: fls. apetalous; calyx gamosepalous, 4-6-parted; stamens 3-9, sometimes exserted; ovary 1-loculed, with 2-3-parted style or stigma (latter capitate), ripening into a triangular or lenticular achene.—The species are perhaps 200 (if the genus is held to include *Persicaria*), of very wide distribution from arctic to tropical countries, and they are of widely different habit, from small annuals, slender twiners, to subshrubs, and ranging in habitat from dry open lands to deep woods and watery swamps. The calyx is corolla-like, often large enough and with sufficient color to render the infl. showy. Polygonum is closely allied to Rumex, the docks, and also to Fagopyrum, the buckwheats. Rumex differs in uniformly having a 6-parted calyx, some of the lobes often bearing



3102. Common knotweed or knotweed.—*Polygonum aviculare*. (×1; the details enlarged)

a grain-like tubercle on the back, the stigmas tufted. Fagopyrum differs in having an achene surpassing the calyx and in details of the embryo. Most polygonums are weedy plants, and only a very small proportion are of merit for cult. One of the commonest species is the doorweed (Fig. 3102), *Polygonum aviculare*. It is a



3103. *Polygonum baldschuanicum*. (Spray × $\frac{1}{4}$)

decumbent wiry small-ld. annual or perennial, growing along walks and in other hard dry soil, where it makes a sod-like mat. The axillary fls. are very small, seldom seen by others than botanists. Other polygonums are the common smartweeds of swales and damp grounds. For monograph of native and intro. species, see Small, "Monograph of the North American species of the genus Polygonum," in Mem. Dept. Bot. Columbia College, 1895.

Most of the cultivated polygonums are hardy border plants, requiring no special skill or care. They are propagated by seed and division, chiefly the latter. The rhizomatous species, as those of the East Asian region, produce readily divisible plants. Some of the cultivated kinds are annual, as *P. orientale*, and this species is the only one that is known as a familiar flower-garden plant, although it is now little grown and the seed is difficult to secure in the trade. *P. sachalinense* is a robust coarse plant of some value where screening foliage is desired and to occupy intractable ground; it was once extravagantly advertised as a forage plant. *P. baldschuanicum* is an attractive and worthy climber, hardy in the northern states. *P. Sieboldii* is one of the best of the species for the back or bold border and is useful for forming single clumps when strong herbaceous foliage effects are desired. The other species are employed mostly in wild gardening or for similar effects. The amphibious kinds make interesting subjects for bog-gardens. The pink or red often curved spikes of the *Persicaria* group are sometimes very ornamental. The

Asian set, from elevations in the Himalayan region and eastward to China and Japan, comprises very interesting plants for rock-gardens and herbaries. The polygonums provide good autumn-blooming plants.

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A. Habit twining.

1. *cilinode*, Michx. Slender somewhat downy climber, mostly perennial: lvs. cordate-ovate to ovate-lanceolate, more or less angular or halberd-shaped at base: st. bearing a ring of retrorse bristles at the base of each sheath (whence the specific name): fls. white, in loose-panicled racemes from the upper axils. Nova Scotia south and west. R.H. 1913, p. 149.—Sold as a cover-plant for rocks and as a denizen of shrub-masses.

2. *baldschuanicum*, Regel. Fig. 3103. Tall perennial climber becoming woody at the base: lvs. cordate-oval or hastate, acuminate, slender-petioled: fls. small but very numerous, in terminal erect or drooping panicles, mostly rose-colored; fruiting calyx small, 3-sided, at first whitish and then becoming rose-colored: achene shining black. Bokhara. B.M. 7544. R.H. 1900, p. 35. Gt. 52, p. 381. G.C. III. 21:17; 41:399. Gn. 55, p. 454; 70, p. 274; 71, p. 19; 79, p. 41. G.M. 50:310. G. 35:657. G.W. 4, p. 253; 15, p. 626. Gng. 5:181.—A very vigorous and decorative hardy plant, climbing 20 ft. high, and, under favorable conditions, producing a profusion of pinkish, or sometimes whitish bloom; hardy N., and worthy greater attention. It was first described by Regel in 1884; bears the name of the town or place Baldschuan.

3. *Aubertii*, Henry. Resembles *P. baldschuanicum*, but said to be inferior to it: climbing to 25 ft. and more, becoming woody at base: lvs. ovate-lanceolate, cordate, obtuse or very short-pointed, reddish bronze or pale green and when young red at the apex: fls. small, whitish, rose-colored or green, in slender axillary panicles 6-8 in. long. W. China, Thibet, discovered by P. Georges Aubert, missionary. R.H. 1907, pp. 82, 83.—Said to grow with great rapidity, and to cover a large space; blooms in spring and again in autumn.

AA. Habit erect, or at least not climbing.

B. Plants annual, of erect habit, to be treated as flower-garden subjects.

4. *orientale*, Linn. (*Persicaria orientalis*, Spach). PRINCE'S FEATHER. Fig. 3104. Tall-growing annual, much branched above, hairy: lvs. large, ovate or cordate-ovate or broad-oblong, acuminate; sheaths short, ciliate and sometimes bordered at the summit: fls. bright pink, in close, cylindrical spikes that are arranged in open panicles, the stamens 7 and the achene lenticular. India. B.M. 213. J.H. III. 51:305. G.W. 6, p. 148.—An attractive old-fashioned plant growing as high as the fence. It is most easy of cult.; in fact, it usually self-sows in old gardens. In some places it has run wild. There are horticultural varieties, as var. *variegatum*, Hort., with foliage marked with yellowish white, and var. *pumilum*, Hort., with compact habit and the stature half that of the type.

5. *Persicaria*, Linn. LADY'S THUMB. One of the annual smartweeds, but sold by seedmen as a suit-

able plant for backgrounds: glabrous or nearly so, erect or somewhat diffuse, 1-2 ft. tall: lvs. lanceolate to linear-lanceolate, slightly ciliate, usually with a triangular or crescent-shaped spot near the middle of the blade (whence the name lady's thumb); sheaths short, hairy on the margin: fls. in short spikes, pink or greenish purple, the stamens 6 and the achene lenticular or triquetrous. Eu.—Naturalized everywhere about dwellings.

6. *arenarium*, Waldst. & Kit. (*P. elegans*, Ten.). Dwarf annual species with slender wiry branches and long internodes: lvs. small, linear-lanceolate, 1-nerved, bearing great numbers of little whitish fls. along the st., the terminal clusters leafless. S. Eu.—Offered in Calif. for rockeries and bouquets.



3104 *Polygonum orientale*. (× 3/4)

BB. Plants perennial, of various habit, usually with strong rootstocks, sometimes shrubby.

C. Species native: smartweed-like plants, sometimes offered for naturalizing in bog-gardens.

7. *amphibium*, Linn. (*Persicaria amphibia*, S. F. Gray). Much spreading and creeping, rooting at the joints, at first more or less pubescent but becoming glabrous with age: lvs. rather thickish and large, oblong, elliptic or lance-elliptic, mostly obtuse or very nearly so; sheaths short, usually not fringed or bordered at the summit: fls. light rose-colored, in a short, dense, terminal spike, the stamens 5 and exserted, and the achene lenticular. In water or bogs, across the continent, and useful for planting in similar places.—When growing in water, the floating lvs. become long-petioled. Var. *Hartwrightii*, Bissell (*P. Hartwrightii*, Gray). Differs from the last in having many narrow-lanceolate lvs., bordered and fringed sheaths, and hispid sts., but the distinguishing mark is the foliaceous border on the sheath. Muddy places, across the continent.

CC. Species exotic, used mostly for borders, and appearing regularly in the trade, largely Himalayan and E. Asian.

D. Whole plant white-wooly.

8. *lanigerum*, R. Br. Sts. thick, creeping at the base, but the tops erect and standing 2-5 ft. high, much branched: lvs. narrow-lanceolate and more or less

recurved, acuminate, covered with down of the color of old silver; sheaths short, not ciliate: fls. small, red or copper-colored (varying to white), in racemes on slender forking peduncles, the stamens 6, and the achene flat and shining black. Tropics and subtropics of Old World and, according to Hooker, of Amer. R.H. 1891, p. 567. Gn. 62, p. 345; 70, p. 167. G.W. 2, p. 419; 13, p. 390.—Perennial and not hardy in the N., but seeds sown early will produce excellent lawn specimens, which are interesting because of the gray foliage and leafy habit.

DD. Whole plant green or grayish, not white-woolly.

E. Fls. greenish or whitish, in very slender and long interrupted flexuose or curving wand-like spikes.

9. *filifforme*, Thunb. Perennial, mostly somewhat hispid, 2-5 ft., with hollow branches: lvs. petioled, pubescent, ovate or oval, short-acuminate: fls. very small, whitish (or rose-colored?), remotely placed in



3105. *Polygonum Sieboldii* (*P. cuspidatum*).
($\times \frac{1}{2}$)

spikes 5-8 in. or more long. Japan.—By some authors thought to be con-specific with the widespread *P. virginianum*, but lvs. less acuminate, bracts shorter-ciliate, fls. and frs. much smaller. Var. *variegatum*, Hort., has lvs. marbled with yellow and pale green: an attractive plant, forming good clumps 1½ ft. high and persisting when well established. R.H. 1912, p. 259.

EE. Fls. pink or red (sometimes varying to white), in erect usually simple stout spikes: plants grown for their fls.

10. *Bistorta*, Linn. (*Bistorta officinalis*, Raf.). BISTORT. SNAKEWEED. Perennial, with a thick more or less spreading rootstock: st. simple, slender but strict, 1-2 ft.: lvs. mostly radical, oblong-ovate and obtuse, undulate, glaucous beneath: st.-lvs. nearly sessile, broad at base; stipules ½-3 in. long: fls. white or pink, in a single dense cylindrical or oblong spike an inch or two

long; stamens exserted; styles 3. N. Eu. and N. Asia.—The astringent rootstock was once used medicinally, and has provided food in famine times. Var. *superbum*, Hort., is offered abroad, with conical heads of bright pink long-lasting fls.

11. *amplexicaule*, Don (*P. oxyphyllum*, Wall. *P. multiflorum*, Hort.). MOUNTAIN FLEECE. Strong-growing tufted green-stemmed perennial with slender fl.-sts. 2-3 ft. tall, from a woody branching rootstock: lvs. cordate-ovate to cordate-lanceolate, short-petioled or clasping, the margin wavy and crenulate, long-acuminate; sheaths 1-2 in. long and split or lacerate: fls. rose-red or white, rather large (sometimes ¼ in. diam.) in strict long-peduncled spikes 2-6 in. long, the stamens 8 and exserted, the achene trigonous. Himalaya, from 6,000-13,000 ft. altitude. B.R. 25:46. B.M. 6500.—An excellent border perennial, blooming in mid-summer. Some, at least, of the plants that have been cult. as mountain fleece are a native polygonum (*P. Muhlenbergii*), which grows nearly throughout N. Amer., including Mex. Var. *speciosum*, Hook. f. (*P. speciosum*, Wall.), has larger deep purplish red or claret-colored fls.

12. *affine*, Don (*P. Brunonis*, Wall.). Tufted glabrous perennial, with flowering sts. 1½ ft. or less high, from a woody prostrate rootstock: lvs. mostly radical, oblanceolate to spatulate to lance-oblong; sheaths rather long, brown, split or entire: fls. bright rose-red, in dense, erect, terminal obtuse spikes 2-3 in. long, the stamens 8, the achene trigonous. Himalaya, at elevations of 9,000-14,000 ft. B.M. 6472.—An excellent little plant for cool places, blooming in autumn.

13. *vaccinifolium*, Wall. Tufted glabrous perennial with trailing and creeping branches, 1 ft. or less tall, and stout twisted rootstocks: fl.-branches leafy: lvs. small (½-¾ in. long), short-stalked, orbicular or elliptic, acute or acuminate, entire, somewhat glaucous beneath; stipules to ½ in. long, brown, lacinate: fls. rose-red, ½ in. diam., in subsessile racemes 2-3 in. long. Himalaya region, 9,000-14,000 and more ft. altitude. B.M. 4622. Gn. 39, p. 543; 43, p. 501; 45, p. 159. G.W. 9, p. 377. J.F. 2:117.

14. *Posumbu*, Hamilt. Dwarf compact perennial, with long-creeping st. which is ascendent or decumbent and simple or branched: lvs. dark green and shining, 1-3 in. long, stalked, broad-lanceolate and narrow-acuminate, glabrous or somewhat hairy, ciliolate; stipules with stiff hairs longer than the sheath: fls. small, rose-colored, in many erect filiform racemes or spikes that are sometimes several inches long. Himalaya and to China and Japan.

EEE. Fls. white to purplish, in panicle or corymbose heads.

15. *chinense*, Linn. *P. cymosum*, Roxbg. *P. polycephalum*, Wall. *P. corymbosum*, Willd.). Shrubby perennial of diffuse or erect habit, 5 ft. high, from glabrous to glandular-pubescent, the many sts. angled and grooved: lvs. 3-5 in. long, stalked, variable in shape, from linear-oblong to deltoid, ovate or even broader, entire or crenulate, the petiole usually 2-eared at base; stipules long and oblique at top: fls. white, rose-color or purplish, borne in many little heads that are panicle or corymbose with usually glandular-hairy peduncles: perianth 5-cleft; stamens 8. Himalaya region and Ceylon to China, Japan, and the Philippines.

EEEE. Fls. white or greenish, in axillary clustered racemes or panicles or cymes: plants grown often for their general foliage effects and bold habit, mostly tall and sometimes woody. (More or less diaceous or polygamous.)

F. Lvs. mostly on the lanceolate order, sometimes ovate, usually taper-based.

16. *polystachyum*, Wall. Shrubby, glabrous, or pubescent perennial, 3-6 ft., the branches grooved: lvs.

petioled or nearly sessile, oblong-lanceolate, narrow-acuminate, usually contracted and more or less cordate or truncate at base: fls. white or pink, $\frac{1}{2}$ in. diam., in large thyrselike spreading terminal panicles with branches erect or decurved and very slender pedicels; 2 outer sepals much smaller than the inner. Himalaya, 7,000–14,000 ft. altitude; Afghanistan. G.C. III. 53, suppl. May 17. G.M. 52:929. M.D.G. 1896:373, 385.—An excellent plant for late autumn bloom, in moist places.

17. *lichiangense*, W. W. Smith. Closely allied to *P. polystachyum*, but branches and stipules setose, lvs. setose above and densely cinereo-tomentose beneath: erect, with a woody base, 2–4 ft., the branches striate: lvs. very short-petioled, 2–5 in. long, lanceolate or oblong-lanceolate, caudate-acuminate, the margin more or less undulate; stipules about 1 in. long: fls. creamy white, in thyrsoid-paniculate clusters at nearly every node, the pedicels slender and about 1 line long. Lichiang Range, China, 10,000–11,000 ft. altitude.—A recent intro., with fl.-sprays said to resemble those of *P. baldschuanicum*.

18. *campanulatum*, Hook f. Pubescent or tomentose perennial, the sts. creeping or stoloniferous at base, forking above, 2–3 ft.: lvs. stalked, 3–6 in. long, elliptic, lanceolate or ovate, acuminate, the base narrow or rounded, more or less pubescent above and below; stipules large, mostly deciduous: fls. pale pink or red in autumn, in divaricately branched nodding or drooping terminal clusters; perianth campanulate, $\frac{1}{2}$ in. long or somewhat larger; stamens 8, with very long filaments. Himalayan region. G.C. III. 52:489.—Variable.

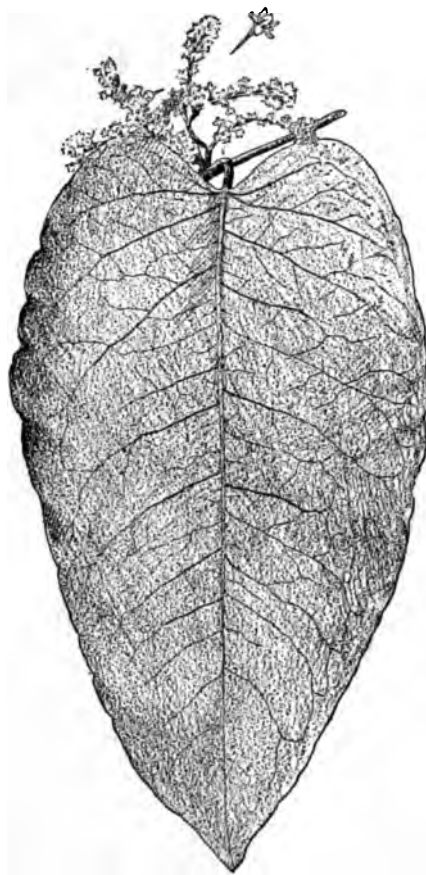
FF. Lvs. much wider, on the oval or broad-oval order, usually (or at least the lower ones) very broad-based.

19. *Sieboldii*, De Vriese (*P. cuspidatum*, Sieb. & Zucc., not Willd. *P. Zuccarinii*, Small). Fig. 3106. Strong stout handsome bushy somewhat woody perennial (stalks dying to the ground in winter), growing 4–8 ft. high, the sts. gracefully curving outward: lvs. short-oval to orbicular-ovate, truncate or slightly cordate at base, abruptly pointed, the strong side nerves uniting in marginal loops; sheaths short and flaring, deciduous: fls. small and whitish, very numerous, in drooping slender-panicled racemes, the stamens 8, and the achenes trigonous. Japan. B.M. 6503. R.H. 1858, p. 631; 1894, p. 54. Gn. 26, p. 317; 49, p. 238. G. 3:143. G.M. 47:861. G.W. 2, p. 76.—A very effective plant for bold mass effects, perfectly hardy in the northern states, and now frequently planted. It is everywhere known in the trade as *P. cuspidatum*. It produces clouds of bloom. Var. *compactum*, Hort. (*P. compactum*, Hook. f.), is of very compact habit, remaining sometimes only 2 ft. high, bearing many erect panicles of whitish fls.: a good subject. B.M. 6476. G.C. III. 47:123. Gn. 63, p. 56. Gn.W. 20:926. Var. *spectabile*, Hort. (*P. cuspidatum* var. *spectabile*, de Norter). Shrubby, 3–5 ft.: lvs. marbled with green, white, and red. R.B. 35, p. 233.

20. *Weyrichii*, F. Schmidt. Tall herb (3 ft.): sts. hispid, in the upper part tomentose: sheaths elongated, membranous, pilose, finally fissured and falling off: lvs. short-petioled, ovate, acuminate, dull green and rugose above, whitish tomentose beneath, to 7 in. long, the lower ones broader and truncate at the base, the upper ones attenuate at the base, revolute at the margin: racemes axillary and terminal, forming a large terminal panicle; rachis fulvo-tomentose; pedicels articulate about the middle; bracts hyaline, glabrous, 2-lobed, 3–6-fld.; stamens 8; achenes 3-angled. Saghalin.—A good hardy perennial for moist ground.

21. *sachalinense*, F. Schmidt. SACALINE. Fig. 3106. Exceedingly vigorous plant, spreading rapidly from the tips of strong underground shoots, the reddish glabrous dead stalks often standing 8–12 ft. high through

the winter: lvs. very large, frequently 1 ft. or more long, soft dull green, the blade oval-oblong, $1\frac{1}{2}$ –2 times as long as broad, shallow-cordate at base, scarcely pointed, the prominent side veins uniting by the ends: fls. greenish, in relatively small axillary clusters, the achene trigonous. Isl. of Sachalin, north of Japan, in Russian territory. B.M. 6540. R.H. 1876, p. 36; 1893, pp. 394, 395; 1894, p. 55. Gn. 21, p. 280; 62, p. 439. G. 5:311. G.C. II. 26:813 and III. 14:159 (in. fr.). G.M. 31:176. V. 17:161.—Recently intro. (in N. Amer. in 1894) for forage and for ornament. It is inveterately persistent when once established, and may easily become a pest. For forage it has little merit where other things can be grown, for it is too coarse. For planting in rough places, where a thick cover is



3106. *Polygonum sachalinense*. ($\times \frac{1}{4}$)

required, it is one of the best of all coarse herbaceous perennials. It is perfectly hardy in the N. and seems to thrive anywhere. *P. Sieboldii* was once distributed as sacaline, but that species is much smaller, with smaller shorter and square-based lvs., and with more profuse bloom.

22. *Spaethii*, Damm. St. erect, 10 ft. and more, thick, minutely puberulent but becoming glabrous, the young growth densely pubescent or somewhat hirsute: lvs. petioled, cordate-ovate, acute or acuminate, the upper ones lanceolate, and attenuate at base, margin somewhat undulate and ciliate; sheath salver-shaped, densely pilose outside, the limb foliaceous, crenate and pilose: fls. in few-fld. paniculate spikes, short-pedicellate, carmine-red; stamens 5–6; achene lenticular. China.—Much like *P. sachalinense*, but differs in its fls., and the pubescence or hairiness.

P. crispulum, Sims.—*Atraphaxis buxifolia*.—*P. cynosuroides*, Trev. (*Fagopyrum cynosuroides*, Meisn.). Puberulous perennial: lvs. triangular: fls. white, secund on long recurved branches of cymes. Himalaya to China.—*P. molle*, Don. Shrubby perennial, allied to *P. polystachyum*, the branches stout, terete and villous: lvs. elliptic-lanceolate, pubescent or tomentose beneath: fls. white, in large thyrs-like tomentose terminal panicles. Himalaya.—*P. multiflorum*, Thunb. Tuberous-rooted climber, with reddish st.: lvs. cordate-ovate, acute, shining: fls. small and whitish, in spreading panicles. China and Japan.—*P. platycaulon*, Hort.—*Muehlenbeckia platyclada*.—*P. scandens*, Hort., as once described, is a twiner, with firm lvs., cordate at base, dark green above and claret-colored beneath. G.C. III. 28: 187.—*P. sericeum*, Pall. Stout perennial, 4 ft., free-branching, with spike-like panicles in July and Aug. of white fls.: densely pubescent: lvs. subsessile, oval-oblong, lanceolate, attenuate at base: fls. in short simple racemes terminal or in upper axils. Siberia.—*P. sphaerostachyum*, Meisn. Allied to *P. affine*, from which it differs in the "dense broad cylindric or globose spike of blood-red pendulous fls.": tufted perennial, suitable for small rock-gardens. Himalaya. B.M. 6847.

L. H. B.

POLYMNIA (the muse Polyhymnia). *Compositæ*. American composites, mostly coarse, viscid and heavy-scented.

The N. American species are tall branching perennials, with usually opposite thin lvs., and the S. American shrubby or tree-like. They have loose panicles of yellow or whitish fls. borne in summer. Heads broad, many-fl.; rays several, pistillate; disk-fls. perfect but sterile.—About 10 species.

canadensis, Linn. CANADA OR SMALL-FLOWERED LEAF-CUP. Height 2-5 ft., the st. clammy-hairy: lvs. deltoid-ovate to hastate, thin, deeply angulate-lobed; lobes dentate, 4-10 in. long: heads few in terminal clusters, 4-6 lines broad; rays minute or none. June-Sept. Damp, rich, shaded places, Vt., Ont. to Minn., south to Ga. and Ark. B.B. 2:405. Var. *radiata*, Gray, with whitish rays sometimes $\frac{1}{2}$ in. long, is also offered by one dealer in native plants: st.-lvs. are more perfectly 3-lobed than in the type.

N. TAYLOR.†

POLYPODIUM (Greek, *many feet*; alluding to the extensive rootstocks). *Polypodiaceæ*. A large group of ferns, some hardy and some tender; the latter are often grown in under-glass collections.

Ferns with naked rounded sori, and with the lvs. joined to the rootstocks, leaving a scar when they separate. As here treated the veins may be free or united to form areoles. The genus is a very extensive one, growing in all parts of the world, and has frequently been divided into a series of genera based on habit and the nature of venation, which is probably a more

3107. *Polypodium vulgare*. ($\times \frac{1}{4}$)3108. Sori and a single sporangium of *Polypodium vulgare*. (Sori about natural size.)

logical treatment; some of these genera, indeed, as *Phymatodes* and *Phlebodium*, have here been separated; the genus would be more homogeneous were others placed by themselves. See comments in connection with *P. Lingua* and *P. Phyllitidis*. For culture, see *Fern*.

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POLYPODIUM

A. Veins free: lvs. once pinnate.

B. Sori large, conspicuous.

1. *vulgare*, Linn. WALL FERN. POLYPODY. Figs. 3107, 3108. Lf.-blades 4-10 in. long, on pale stalks half their length, 1-3 in. wide, cut nearly or quite to the rachis into entire or slightly toothed blunt pinnæ. New England to Ala. and westward to Ore.; also common throughout Eu., where many forms are in cult.

3109. *Polypodium vacciniifolium*. ($\times \frac{1}{4}$)

Var. *cambricum* (Fig. 3110) occurs in N. Y. and New England. Very many other varieties are cult. in England but unknown to American trade.

2. *falcatum*, Kellogg. Lvs. 12-15 in. long, 4-8 in. wide, on long, straw-colored stalks; pinnæ numerous, tapering to a slender point, sharply serrate. Calif. to Wash.

BB. Sori smaller.

3. *Plumula*, HBK. Lvs. 9-18 in. long, narrow-lanceolate, 1-2 in. wide; pinnæ numerous, narrow, entire, blunt, the lower pairs scarcely smaller than those above; stalks blackish. Fla. and Trop. Amer.

4. *pectinatum*, Linn. Lvs. elliptic-lanceolate, 1-2½ ft. long, 2-6 in. wide, cut to the rachis into horizontal entire or toothed pinnæ, the lower ones gradually reduced to short, triangular lobes. Fla. and Trop. Amer.

AA. Veins uniting, forming regular areoles each with a single free included veinlet.

B. Lvs. simple, undivided.

5. *vacciniifolium*, Langs. & Fisch. Fig. 3109. Lvs. small, of two sorts, rising from slender, wide-creeping rootstocks; sterile lvs. roundish or elliptic; sporophylls linear or ligulate, with large sori in a single row. Trop. Amer., from the W. Indies southward.

BB. Lvs. pinnate.

c. Fronds covered with flat scales underneath.

6. *polypodioides*, Hitchc. (*P. incanum*, Swartz). Lvs. 2-6 in. long, an inch or more wide, with entire pinnæ which are usually more or less revolute; veins indistinct, from the thick texture. Va. and S. Ill. to Brazil; commonly growing on trees in the southern states.—Known as resurrection fern from its ability to revive after long drying.

cc. Fronds smooth beneath.

d. Pinnæ broad at base and often confluent.

7. *californicum*, Kaulf. Lvs. 4-9 in. long, 1-5 in. wide, cut into finely toothed pinnæ which are mostly confluent at the base. Calif.—Has much the habit of the European forms of *P. vulgare*.

8. *Catharinae*, Langs. & Fisch. Lvs. 6-12 in. long, 3-5 in. wide, with numerous nearly opposite pinnae which are dilated at the base, contracted just above the base, and slightly enlarged and bluntly rounded at the tip; sori large near the midrib. Brazil.

DD. *Pinnæ narrowed and distinct at base.*

9. *fraxinifolium*, Jacq. Lvs. 2-4 ft. long, 12-18 in. wide, on firm stalks 1-2 ft. long; pinnae 4-9 in. long, with a tough, somewhat leathery texture and entire margin. Columbia to Brazil and Peru.

10. *subauriculatum*, Blume. Stalks 6-12 in. long, glossy, from wide-creeping rootstocks: lf.-blades 2-3 ft. or more long, 8-12 in. wide; sori in a single row immersed in the leaf. India to Austral.

AAA. *Veins (primary) distinct from midrib to the edge, connected by parallel transverse veinlets forming rows of similar areoles.*

B. *Lvs. elongate, simple, smooth beneath.*

11. *Phyllitidis*, Linn. (*Campyloneuron Phyllitidis*, Presl). Lvs. 1-3 ft. long, 1-4 in. wide, with an acute point, and the lower part narrowed gradually; areoles in rows of 6-12, usually with 2 sori each. Fla. to Brazil.—This species might more justly be placed in the genus *Campyloneuron*.

BB. *Lvs. with under surface tomentose.*

12. *Lingua*, Swartz. Lf.-blades 4-8 in. long, 1-2 in. wide, the apex often cuspidate, the base narrowed or rounded; upper surface naked, the lower matted with reddish brown cottony scales, the sori in close rows of 4-6 each. Japan to Ceylon.—This species and the next are often more properly listed in the genus *Cyclophorus*. There are a few crested and other horticultural forms.

13. *tricuspis*, Swartz. Lvs. hastate, 2-4 in. each way, with a central lanceolate-triangular lobe and spreading lateral ones which are more or less auricled at the base. Japan and Korea.

P. aureum = *Phlebodium*.—*P. Dryopteris* = *Phegopteris Dryopteris*.—*P. glaucum* = *Phymatodes*.—*P. hexagonopterum* = *Phegopteris*.—*P. Kerandrednum* = *Phegopteris*.—*P. lepidopteris*, Langs. & Fisch. (*P. sepultum*, Kaulf. *Lepicystis sepulta*) is a very scaly pinnatifid form from Trop. Amer., of some interest for collectors. —*P. muscifolium* = *Phymatodes*.—*P. nigrescens* = *Phymatodes*.—*P. Phegopteris* = *Phegopteris polypodioides*.—*P. Phymatodes* = *Phymatodes*.—*P. plumosum* is a form of *Asplenium Filix-foemina*.—*P. quercifolium* = *Drynaria*.—*P. rigidulum* = *Drynaria*.—*P. Swartzii* = *Phymatodes*.



3110. *Polygodium vulgare* var. *cambricum*. (×½)

L. M. UNDERWOOD.

POLYPTERIS (Greek words meaning *many-winged* or *feathered*; referring to the pappus). *Compositæ*. This includes a handsome, rosy-flowered hardy annual known to the trade as *Palafoxia Hookeriana*.

Polypteris is a genus of 4 species of N. American herbs: lvs. mostly entire: alternate heads of pedunculate, rose-purple or flesh-colored fls. borne in summer and autumn: involucre broadly bell-shaped or top-shaped; bracts commonly in 2 series, more or less colored and petal-like toward the tips: rays wanting except in *P. Hookeriana*: achenes linear to club-shaped, 4-sided; pappus of 6-12 equal scales. Distinguished from *Palafoxia* by the colored tips of the involucral bracts and the deeply divided limb of the corolla. By some the genus is united with the older genus *Palafoxia*, which is also American.

Hookeriana, Gray (*Palafoxia Hookeriana*, Torr. & Gray). A stout annual 1-4 ft. high, sticky pubescent: lvs. lanceolate, mostly 3-nerved below: heads 1 in. or more across; rays 8-10, deeply 3-cleft, rose-red, about ½ in. long and showy. Sandy plains, Neb. to Texas. B.M. 5549.—Handsome plant; sometimes treated as an everlasting.

N. TAYLOR.†

POLYRRHIZA (Greek, *many roots*). *Orchidaceæ*. Epiphytes: sepals and petals spreading, labellum 3-lobed, lateral lobes small, angular, middle one with spreading lobes; spur long, filiform; column short; pollinia 2. The following are intro. into American horticulture:

Lindenii, Rolfe (*Dendrophylax Lindenii*). Scape leafless, bearing a single white fl.; sepals and petals lanceolate; divisions of midlobe of labellum lanceolate: caps. smooth. On *Oreodoxa Regia*, and live oaks, S. Fla.

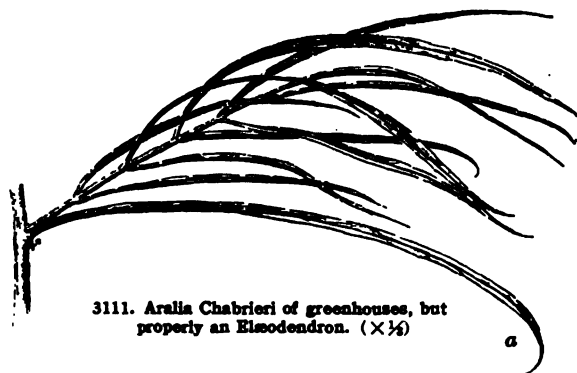
funalis, Pfitz. (*Dendrophylax funalis*, Hort. *Eccolades fundalis*, Lindl. *Angræcum fundale*, Lindl.). Leafless, roots numerous, fleshy: peduncles 2-fl.; fls. white; sepals and petals oblong-lanceolate; labellum 3-lobed, with a long horn. Mountains of Jamaica.

OAKES AMES.

GEORGE V. NASH.†

POLYSCIAS (*many and shade*; referring to the abundant foliage). *Araliaceæ*. Large shrubs or trees, glabrous, comprising the pinnate-leaved tender aralias of greenhouses, grown for the ornamental foliage.

Leaves pinnate, with variable lfts., in many horticultural forms much cut, modified and often variegated: fls. very small, usually 5-merous (sometimes 4-merous), the calyx truncate or toothed, the petals valvate, the ovary 5-8-loculed; the styles usually of the same number and distinct.—About 70 species are described, from India, Trop. Afr., and Pacific Isls., some of which probably belong in other genera. Recent introductions from New Caledonia and other islands have given interesting forms for the cultivator. In cult. very rarely flowering; some specimens of *P. fruticosa* known to be 15 years old or more have never blossomed. From the temperate *Aralia*, comprising the *Hercules* club, the genus is easily told by its lack of spines and also by the technical floral characters of little value to horticulturists, as the tender sorts rarely flower. From *Panax*, the ginseng, the genus is separated by its woody habit. From *Fatsia*, the true *Polyscias* is distinguished by having the pedicel usually articulated beneath the fl. The genus *Dizygotheca* is distinguished by digitate lvs. of many lfts., and 4-celled anthers and 10-celled ovary



3111. *Aralia Chabrieri* of greenhouses, but properly an *Elmiodendron*. (×½)

(the allied genera have 2-celled anthers and mostly less than 10-celled ovary).

The glasshouse aralias are much confused botanically. The genus *Aralia* as understood by the older botanists turns out to be a polymorphous group, and in the segregation of other genera it is often difficult properly to redistribute the species. This is particularly true

of the cultivated forms, many of which are not only variable but the flowers and fruits may be unknown. Any arrangement of these forms must be considered to be tentative.

Four distinct types or forms of tender greenhouse aralias are illustrated herewith. Fig. 3111 is the *Aralia*



3112. *Dizygotheca elegantissima*. The *Aralia elegantissima* of greenhousea. ($\times \frac{1}{4}$)

Chabrieri of gardens. It has very long glossy stiffish long-pointed leaves with a dark red midrib, the margin entire or remotely denticulate and more or less revolute. These leaves are opposite or nearly so on short side branches, as if parts in a compound leaf, and apparently confusion has arisen in descriptions. In the illustration, a leaf is shown at *a*, in the axil of which is a branch bearing the leaves. This plant, which is cultivated in its juvenile state, has been little understood botanically. It is not an aralia nor of the aralia family, although referred doubtfully to Polyscias. It is now considered to be *Elæodendron orientale* (see page 1107, where the matter is left in doubt). Harms, an authority on these plants, has recently gone over the question (Gt. 62, pp. 533-5, and 63, p. 117), and has concluded that the plant is *E. orientale*. Guillaumin (R.H. 1912, p. 491) considers it to be an *Elæodendron* but not *E. orientale*. The long linear leaves with red mid-rib are merely the young form of the species, and they pass into the broad-lanceolate or shorter oval or obovate thick leaves of the mature plant. *Aralia Chabrieri* apparently appeared first under this



3113. Terminal leaflet of *Polyscias fruticosa*. Adapted from Blanco, *Flora de Filipinas*; much reduced.

name in 1881 in the catalogue of Van Geert, Ghent. For portraits of it, see R.B. 13:20 (1887); R.H. 1891, p. 224; Gn. 39, p. 576.

The florists' plant shown in Fig. 3112 is *Dizygotheca elegantissima*, Vig. & Guill. (*Aralia elegantissima*, Veitch). Very similar plants are *Aralia Veitchii*, Hort. Veitch, and its var. *gracillima*, Hort. Bull. (*A. gracillima*, Hort. *A. gracilina*, Lind. R.H. 1877, p. 38), its var. *robusta*, Hort., and *A. Kerchoveana*, Hort. It is not unlikely that all the plants mentioned above in this paragraph are foliar forms of one species, representing a juvenile state of a *Dizygotheca* (page 1062), although it is possible that other generic disposition will be made of these things when the different forms and the flowers and fruits are known. These names, as represented in plants in the trade, however, are of two groups: (1) *Aralia Veitchii*, *A. Veitchii robusta*, and *A. gracillima* with undulate nearly or quite entire leaflets, which may be tentatively called *Dizygotheca Veitchii*, Hort.; (2) the other group is *A. Kerchoveana* and *A. elegantissima*, with strongly notch-toothed leaflets, which are about 1 in. broad in the former and about half as wide in the latter; the former is *Dizygotheca Kerchoveana*, Hort., and the latter *D. elegantissima*, Vig. & Guill.

The plants shown in Figs. 3113 to 3117 are by some referred to *Nothopanax*; but until their position is better

determined, they may be described tentatively under Polyscias. *Nothopanax* understood by Harms has leaves primarily digitate whereas Polyscias has leaves on the pinnate order; as defined by others, however, *Nothopanax* comprises species with leaves simple, pinnate or pinnately compound. As in many of the araliads, the leaves in this general group are very variable. Harms calls attention to the fact that in *Nothopanax* the leaves may be different on the same plant in successive ages. On the young plants the leaves are mostly digitate with the leaflets



3114. *Polyscias Guilfoylei*.

often once-pinnatisect; older plants have simple leaves and the leaflets entire or toothed or once-pinnatisect, or sometimes only digitate leaves.

The culture of the several kinds of plants known to florists and greenhouse men as aralias is not difficult. Among the most desirable tropical kinds, are those known in the trade as *Aralia* (*Elæodendron*) *Chabrieri*, *A. elegantissima*, *A. Veitchii*, *A. gracillima*, *A. leptophylla* (all *Dizygotheca*), *A. monstrosa*, *A. Victorix*, *A. plumatum*, (all Polyscias) and others. Aralias are increased by cuttings and by grafts. *A. leptophylla*, and the forms of *A. Veitchii*, are rarely propagated except by grafting. The stock considered by many to be the best to use is *A. reticulata* (probably *Oreopanax reticulatum*, Fig. 2676, Vol. IV, which is *Meryta Denhamii*). Cuttings of it about the thickness of an ordinary pencil may be secured, and established in small pots, when they may

be cut back to a little above the base, and the cion inserted. Either the cleft or wedge method has been successful. They must be kept in a night temperature of not less than 70°F., and placed in a tight moist case until they unite. Aralias may also be propagated from cuttings, eyes, or pieces of the root. A plant that has become bare of leaves may be cut down near the pot; the stem should be cut in 2-inch lengths, and put in as



3115. *Polyscias Guilfoylei*. (×½)

eye-cuttings, in a brisk heat in the propagating-bed. The old stool may be put in bottom heat, when many of the varieties will throw several nice cuttings from the base. These should be removed with a heel, when about 6 inches long, and put in as cuttings, in a bottom heat of about 75°, and potted off when rooted. To procure root-cuttings, one of the strongest plants should be turned out of the pot, and the soil washed out of the roots with a hose. Cut the stronger parts of the roots in 2-inch lengths, and place in small pots. The

end nearest the stem should be nearest the surface of the pot. Plunge the pots in a tight case, in 70° to 75° bottom heat, and water carefully until they throw up shoots.—A sandy peat is the best soil in which to grow the finer rooting varieties. The stronger-growing kinds thrive in a richer compost,—say two parts fibrous loam, one part leaf-mold, a little well-rotted manure, charcoal, and sand enough to keep the whole porous. Greenhouse kinds should be in a night temperature of not over 50° when established in their pots. They may be set outdoors in a shady position in summer. The tropical kinds must be kept at not less than 60° night-temperature. Aralias must at all times be shaded from strong sunshine. Watering with soot-water gives a nice gloss to the foliage. *Aralia*, or *Panax*, *Victoria* may be treated the same as the other aralias. Insect pests can be kept in check on aralias by the syringe and by fumigating with hydrocyanic gas, one-half ounce to the thousand cubic feet. The usual precautions of lowering the temperature to 60°, and having the foliage dry when the operation is performed, should be observed. (George F. Stewart.)

paniculata, Baker (*Terminalia elegans*, Hort. *Gilbertia paniculata*, DC.). Erect glabrous shrub: lvs. pinnate, 6–9 in. long, usually with 7 lfts. of which the terminal one is 7–9 in. long, oblong and obtuse, shining, deltoid or somewhat rounded at base: fls. in somewhat spicate (not paniculate) racemes 2–4 in. long, on very short and thick pedicels and not articulated; petals and stamens about 16: fr. hemispherical, with 6 styles and as many grooves. Mauritius.—This is another example of the confusion which arises from the naming of garden plants before their fls. or frs. are known. For several

years this plant was supposed to be a *Terminalia* (cf. G.C. III. 2, p. 366).

pinnata, Forst. (*Aralia latifolia*, Wight & Arn.). Lfts. orbicular to oblong, either nearly entire or with small and remote teeth, the base obtuse or heart-shaped, the apex acuminate: fls. 5–7 in each umbel of the panicle. Malaya.—The *Aralia latifolia* of gardeners may not be the above plant, and it seems to be little cult.

fruticosum, Harms (*Panax fruticosum*, Linn. *Aralia fruticosum*, Hort. *Nothopanax fruticosum*, Miq. *Panax excelsum*, Hort., at least in part). Fig. 3113. Erect shrub, to 6 or 8 ft. high, glabrous, the young branches with prominent lenticels: lvs. more or less irregularly pinnately 3-compound, the petiole and rachis more or less spotted, and the petiole-base expanded and clasping; lfts. stalked, with the segms. also stalked and parted or cut into narrow-ovate or oblong or lanceolate ultimate segms. with scariously spinulose-toothed margins and very acute apices, the whole lf. having a much-divided soft appearance: infl. terminal and in the upper axils, 3–6 in. long and many-fld., the fls. umbellate and short-pedicelled: fr. broad-ovoid, compressed, more than 1 in. long. Polynesia to India, commonly cult. and in many lf.-forms. In some cases the lvs. are much cut and the segms. are reduced to very narrow even to linear or thread-like forms. Var. *plumata*, Bailey (*Panax plumatum*, Hort. *Nothopanax fruticosum* var. *plumatum*, Merr.), has smaller lvs., 8 in. or less long, the ultimate segms. much smaller and finer and mostly lanceolate or linear-lanceolate. See also *Panax Deleuanum*, suppl. list, p. 2748.

Guilfoylei, Bailey (*Aralia Guilfoylei*, Bull. *Nothopanax Guilfoylei*, Merr.). Figs. 3114, 3115. Erect glabrous shrub, to 15 ft. and more, not much branched, with bright green usually white-edged foliage: lvs. large, often 16 in. and more long, regularly pinnate, with more or less spotted or lined petiole which is expanded and clasping at base; lfts. stoutly short-petiolate, well separated from each other, ovate to elliptic-ovate to nearly orbicular, tapering or rounded or truncate at base, with distinct and mostly rather remote short teeth which are sharply acuminate-pointed, in the usual cult. forms with white margins or variously white-shaded and blotched; terminal lft. large, often 6 in. long and 5 in. broad. Planted in tropical countries about yards and for screens or hedges, and probably native somewhere in the Pacific Isls.; often called "wild coffee" and "coffee tree," probably from the foliage. It may be seen now and then in greenhouses, although mostly in the smaller and cut-lvd. forms. It appears rarely to produce flowers. Its origin is not traced; by some it is thought to be a modified form of *P. pinnata* or some related recognized species. F.M. 1874:100.—*A. Guilfoylei* appears to have been first described in Bull's Catalogue for 1873 under "new plants announced for the first time," as fol-



3116. *Polyscias Guilfoylei* var. *laciniata*.

lows: "This fine and distinct ornamental stove plant is a native of the South Sea Islands. It is of shrubby habit, with an erect stem, copiously dotted with lenticular markings, and having pinnate leaves on longish smooth terete petioles, and made up in the case of young plants of from three to seven stalked oblong-elliptic bluntish leaflets which are sometimes obscurely lobed, and irregularly spinose-serrate; these leaflets vary in size from two to three inches long, and are neatly and evenly margined with creamy white, the surface being in addition occasionally splashed with gray."

Var. *laciniata*, Bailey (*Panax laciniatum*, Hort.), Fig. 3116, has the white margins of the lfts. deeply cut into very narrow spreading divergent teeth. Var. *monströsa*, Bailey (*Aralia monströsa* and *Panax monströsum*, Hort.), has the lfts. irregularly cut and jagged, often very oddly so and of different sizes and shapes, the margins white and deep-toothed: one of the many lf.-forms which are named *laciniata*, *monströsa*, etc. R.H. 1891, p. 225. Gn. 39, p. 565. A form with golden green variegation is *Panax monstrosum aureum* of the lists. Var. *Victörise*, Bailey (*Panax Victorise*, Rod. *Aralia Victorise*, Hort. *Nothopanax fruticosum* var. *Victörise*, Merr.). Fig. 3117. A small close-growing plant (as seen in cult.) with much-divided lvs., the lfts. or segms. small and of different sizes and shapes. A good compact form, frequent in green-houses, which constantly sends up new stalks and yields recurving tasselled light green white-margined foliage; recommended as a good table plant. G.C. II. 19:405. I.H. 31:521.

Balfouriæna, Bailey (*Aralia Balfouriæna*, Sander. *Panax Balfourii*, Sander). Compact and bushy shrub, in cult. well furnished with foliage from base to top: st. bronze-green, speckled with gray: lvs. with long slender petioles (3-5 in. long) which are more or less marked and lined and dilated-clasping at base; lfts. usually 3, long-stalked, orbicular or reniform in outline, cordate at base, very obtuse or broad at apex, coarsely



3117. *Polyscias Guilfoylei* var. *Victörise*.

crenate or crenate-dentate, the teeth apiculate and sometimes with minor spinulose serratures, margined or blotched with white. Intro. from New Caledonia.—Thought to be a form of *P. pinnata* by some. *R. Rumphiana*, Harms, is to be studied in this connection.

filicifolia, Bailey (*Aralia filicifolia*, Moore. *Panax filicifolium*, Hort. *A. spectabilis*, Hort.). Fig. 3118. Strong erect glabrous shrub, with large lenticels and usually with purplish branchlets: lvs. variable, even on the same plant as it attains age (as in Fig. 3118); as commonly seen in cult. young plants, the lfts. are long-lanceolate or narrowly oblong-lanceolate,

narrowed at base, and deeply pinnatifid, the narrow acute segms. being spinulose-serrate; on older shoots or plants, the lfts. may be much larger and broader, still narrow at the base, and merely spinulose-dentate; as the plant matures it produces also very broad-ovate or broad-oblong thick nearly or quite entire lfts., with broad or truncate or even subcordate base, very unlike those already described. Pacific Isls. I. H. 23: 240. J. H. III. 48:337. R. H. 1891, p. 224. Gn. 39, p. 565.—Known in some places in tropics as "angelica."

The above account comprises the cult. aralias that are most likely to be met with and to be referred to this group. Undoubtedly some of the garden names under *Panax* belong in *Polyscias*. The following are names under *Panax* (not under *Polyscias*) which are in doubt or of which combinations appear not to be recognised under *Polyscias*: *Panax cochledatum* DC. (*Nothopanax cochleatum*, Merrill). Erect shrub, to 10 ft.: lvs. simple, 2-5 in. across, nearly orbicular, cordate, somewhat concave



3118. *Polyscias filicifolia*. All leaflets from the same plant. (X 1/2)

above, remotely spinulose-dentate. Cult. in Pacific tropics.—*P. crispatum*, Bull. (*Nothopanax crispatum*, Merrill). Shrub, to 6 ft.: lvs. triangular, decomposed, the lfts. deeply incised and toothed, oblong-obovate to broad-ovate, green, the lateral ones overlapping. Probably Brazil, but widely disseminated in tropics.—*P. Deleuanum*, Hort., is properly *P. fruticosum* var. *Deleuanum*, N. E. Br. A variation with irregularly pinnate lvs. and digitately cut segms., the ultimate segms. variable, but cuneate at base, toothed and cut and white-toothed. Polynesia. I.H. 30:492. Known also as *Aralia Deleuana*.—*P. diffusum*, Bull. Form of *P. fruticosum*, with bright green, crisped lfts., which are linear-oblong and spiny-toothed. Polynesia.—*P. dissectum*, Bull. Erect, branching, the 2-pinnate lvs. drooping, the lfts. cuneate-obovate and toothed and often 2-lobed.—*P. divaricatum*, Sieb. & Zucc.—*Acanthopanax divaricatum*, p. 193.—*P. dumosum*, Bull. Short-stemmed: lvs. roundish ovate, pinnately divided, the variable ultimate divisions spiny-toothed.—*P. flsum*, Bull. St. marked with pallid spots: lvs. 3-pinnate, the lfts. linear-lanceolate and whitish toothed. Polynesia.—*P. lepidum*, Bull. Compact: lvs. biternately divided, the end division largest; pinnules or ultimate lfts. obliquely obovate, the central one in each case small (sometimes almost rudimentary) and more or less covered by its 2 lateral ones, the margins spiny-toothed and cut. Brazil.—Recent. Scarcely known in cult. in Amer.—*P. Mastersianum*, Sander. Of climbing habit, with long-stalked drooping pinnate lvs. about 3 ft. long, the petiole greenish, tinged with pink and marked with white, the lfts. oblong-lanceolate and toothed. Solomon Isls. G.C. III. 23:242.—*P. multifidum*, Hort., is properly *P. fruticosum* var. *multifidum*, N. E. Br. Compact plant, with 3-pinnatisect lvs. and linear or linear-lanceolate segms. 1/2 in. or less long, with bristly teeth.—*P. Murrayi*, Muell. (*Aralia splendens*, Hort.). Tree in its native place, with drooping, shining green pinnate lvs. 3-4 ft. long, and many oblong-lanceolate lfts. 3-6 in. long: umbels of brownish fls. in long terminal panicles. S. Sea Isls. Austral. B.M. 6798. Perhaps true *Aralia*.—*P. nitidum*, Bull. Compact: lvs. roundish obovate, toothed and somewhat spiny, sometimes with deep incisions. Brazil.—*P. ornatum*, Bull. (*Nothopanax ornatum*, Merrill). Slightly branched shrub, to 10 ft.: lvs. long, pinnate, the 11-17 lfts. narrow-lanceolate and deeply blunt-toothed, sometimes pinnately lobed, irregular in shape: fls. greenish white, the panicles terminal or in the upper axils: fr. about 1/2 in. long, purple. Probably Brazil, but widely cult. in tropics.—*P. sessiliflorum*, Rupr. & Max.—*Acanthopanax sessiliflorum*, p. 192.

L. H. B.

POLYSTACHYA (Greek, referring to the many spikelets). *Orchidaceæ*. Tropical epiphytic orchids, few of which have showy flowers.

Sepals connivent or subpatent, the lateral ones connate with the short foot of the column into a mentum; column short; flowering sts. short, few-lvd., pseudobulbous.—About 80 species. For cult., see *Orchid*.

lutæola, Hook. (*Dendrobium polystachyon*, Swartz). Height 6–12 in.: lvs. oblong-linear or lanceolate-oblong, exceeded by the st.: fls. small, greenish yellow; lip 3-lobed to the middle. S. Fla. and Trop. Amer.

P. appendiculata, Kränzl. Fls. small, yellow; upper sepal with short, subulate, spur-like appendage attached to back a little above base. Trop. Afr.—*P. bicolor*, Rolfe. Plant very small: st. tufted; lvs. lanceolate-oblong; scapes 3–5 in. long; fls. small; sepals light purple; petals cream-white. Seychelles.—*P. campyloides*, Rolfe. Lvs. oblong or linear-oblong, 2–4 in. long; scape 2 in. long, 1- or few-fld.; fls. green, with brown on foot of column and base of lip. Trop. Afr.—*P. coriacea*, Rolfe. Lvs. linear-oblong, 4–6 in. long; racemes densely fld.; sparingly branched at base; fls. minute, deep yellow. Cent. Afr.—*P. dendrobiflora*, Reichb. f. Fls. up to 20 together, in a short corymb, white, suffused with pale rose, resembling in size and shape *Dendrobium Fytchianum*.—*P. ensifolia*, Lindl. Sta. erect, bearing linear-oblong lvs. 4–6 in. long; fls. numerous, tawny yellow, borne on an erect infl. Trop. Afr.—*P. ferdusa*, Schlecht. Scape slender, about 1 ft. long, terminated by a lax raceme of small white fls. with a purple-spotted lip. E. Trop. Afr. G.C. III. 44:276.—*P. golungensis*, Reichb. f. Plant about 4 in. high; infl. branched, with many small light yellow fls.—*P. Haroldiana*, Hort. Fls. white, sepals tinged with green, borne on a short spike. Trop. Afr.—*P. Laurentii*, Wildem. Plant trailing: lvs. fleshy, green; fls. in panicles, white or cream-white. Congo.—*P. Lawrenceana*, Kränzl. St. pubescent; raceme 4–8-fld.; fls. yellowish green, the lip rose-pink; sepals spreading, puberulous, the dorsal ovate, acute, about $\frac{1}{4}$ in. long; petals incurved, oblong-oblancoate, subobtusate, about as long as sepals; lip 3-lobed, about $\frac{1}{2}$ in. long, the front lobe fleshy, nearly orbicular. Trop. Afr. B.M. 8211.—*P. mystacidioides*, Wildem. Sta. branched, over 3 ft. long; lvs. lanceolate, dull green, covered with tiny dots; fls. lurid purple and flesh-colored, $\frac{1}{2}$ in. long, solitary. Congo.—*P. paniculata*, Rolfe. Pseudobulbs flattened, the young shoots blotched with purple; racemes panicled; fls. from coppery yellow to reddish orange. Trop. Afr. G.C. III. 48:462; 58:85. B.M. 8618.—*P. repens*, Rolfe. Small, creeping; fls. about $\frac{1}{4}$ in. long; sepals and petals buff-yellow striped with brown; lip deep red-brown. Uganda.—*P. stricta*, Rolfe. Panicle erect, 9 in. long; fls. $\frac{1}{4}$ in. long, light greenish yellow, with faint purple streaks. Trop. Afr.

GEORGE V. NASH.†

POLYSTICHUM (Greek, *many rows*; referring to the sori). *Polypodiaceæ*. A group of ferns mostly of temperate regions, some species of which do well in living-rooms.

Veins free and the roundish sori covered by indusia that are peltate and attached to the leaf by a short central stalk. They are mostly easily grown and thrive best in shade. One species is very commonly grown for fern-dishes. All the species have also been described by some authors under the genus *Aspidium*. For culture see *Ferns*.

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A. Lvs. simply pinnate throughout.

B. Lower pinnae gradually reduced to mere lobes.

1. *Lonchitis*, Roth (*Aspidium Lonchitis*, Swartz). HOLLY FERN. Lvs. 9–20 in. long, rigid, the pinnae broadly lanceolate-falcate, the lowest triangular. N. Eu. and Amer., mostly in high latitudes.

BB. Lower pinnae scarcely if any smaller than those above.

2. *acrostichoides*, Schott (*Aspidium acrostichoides*, Swartz). CHRISTMAS FERN. DAGGER FERN. Figs. 3119, 3120. Lvs. growing in dense crowns, with stalks 6–8 in. high, the pinnae linear-lanceolate, somewhat falcate, and serrulate with appressed teeth; spore-bearing pinnae contracted, with confluent sori. E. U. S.—One of our commonest species. The common name is due to the evergreen character of the lvs. which are picked by the thousand and sold in bales to florists.

3. *munitum*, Kaulf. (*Aspidium munitum*, Kaulf.). Stalks 4–12 in. long, chaffy at base or throughout; pinnae long, linear-acuminate, serrate or doubly ser-

rate; sori in a single row midway from midrib to margin. Utah northward and westward.

4. *lepidocaulon*, Hook. Stipes densely clothed with large, heart-shaped scales; lf.-blades short, with 12–15 pairs of pinnae, unequal-sided, scarcely toothed; sori usually in two rows. Japan.



3119. Christmas fern.—*Polystichum acrostichoides*.

AA. Lvs. with auricles of pinnae forming distinct lfts.

5. *viviparum*, Fée. Lf.-blades 12–18 in. long, 4–6 in. wide, with numerous lanceolate pinnae; lower basal margin obliquely truncate; sori in 2 or 4 rows. W. Indies.

AAA. Lvs. bipinnate in the lower two-thirds.

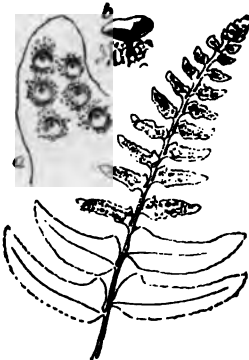
B. Pinnules auricled.

6. *aculeatum*, Roth (*Aspidium aculeatum*, Swartz). Lf.-blades 2 ft. or more long, 6–8 in. wide; pinnules twice as long as wide, with very conspicuous basal auricles. Eu. and Calif. Hardy.—*P. proliferum*, Hort., is an Australian form producing buds on the lvs. A large number of varieties are grown and offered for sale by English florists, but they are not of a sort to be of value in American trade.

7. *Tsusiense*, J. Smith (the name is often incorrectly spelled *tensemense* in the trade). Fig. 3121. Lvs. commonly 6 in. long, 2–3 in. wide, the petioles slender, dark, the lvs. dark green.—Somewhat like *P. aculeatum* but well distinguished both in size and general appearance. This is one of the ferns commonly used for fern-dishes.

8. *angulare*, Willd. Lf.-blades 1–2 ft. long, rather narrowly lanceolate; pinnules nearly triangular, two-thirds as broad as long, more or less incised. Eu.—Another favorite with English growers who offer many varieties. Hardy. See *P. aculeatum* above.

9. *Braunii*, Lawson. Lf.-blades 18–24 in. long, narrowly elliptic-lanceolate; pinnules 7–10 pairs to each pinna, broad, the upper basal edge parallel with the rachis. Europe and mountain regions of eastern America.—Sometimes considered a variety of *P. aculeatum*.



3120. Details of tip of fertile leaf of *Polystichum acrostichoides*. a, sori; b, indusium.

BB. *Pinnules scarcely awicled.*

10. *Richardii*, Hook. Lf.-blades 9-18 in. long, ovate-deltoid, with 12-15 pairs of pinnæ; pinnules deeply toothed, texture coriaceous. New Zeal.

11. *amabile*, Blume. Lf.-blades 1 ft. or more long, 6-9 in. wide, with a lanceolate terminal pinna and 3-6 pairs of lateral ones; pinnules sub-rhomboidal, the upper and outer portions sharply spinulose serrate. India, Japan, and E. Indies.

AAAA. *Lvs. more than twice pinnate in the lower pinnae.*

12. *capense*, J. Smith (*P. coriaceum*, Swartz). Stalks scattered, 1-2 ft. long; lf.-blades 1-3 ft. long, leathery, sub-deltoid, the segms. lanceolate and bluntly lobed, the teeth not mucronate. S. Afr., S. Amer., and New Zeal.



3121. *Polystichum Tsus-sinense*. (Small plant.)

13. *aristatum*, Swartz. Stalks scattered, 12-18 in. long, scaly below; lf.-blades 1-2 ft. long, 9-12 in. wide, 3-4-pinnatifid, the lower pinnae largest; texture firm, glossy; sori in 2 rows near the midrib. Japan to Ceylon and Austral.

14. *varium*, Presl. St. partly creeping; lvs. 1½-2 ft. long, 9-12 in. wide, narrowly triangular, 3-pinnate in lowest pinnae, somewhat leathery. Japan, China.—Similar to *P. capense*.

L. M. UNDERWOOD.
R. C. BENEDICT.†

POMADÉRRIS (Greek, *lid* and *skin*, said to allude to the membranous covering of the capsule). *Rhamnaceæ*. Shrubs, more or less covered with hoary or ferruginous stellate tomentum. The Victorian hazel, *P. apetalá*, is included here.

Leaves alternate; fls. numerous, in small cymes usually forming terminal or axillary corymbs or panicles; calyx-tube adnate to the ovary, limb 5-parted, deciduous or reflexed; petals 5 or wanting; stamens 5, the filaments elongated and often suddenly attenuate and inflexed at the top; ovary more or less inferior; caps. small, the upper portion protruding above the calyx-tube, 3-valved.—About 22 species confined to Austral., New Caledonia and New Zeal. Several species have been cult. in England at different times but *P. apetalá* seems to be the one most commonly cult. Prop. by cuttings of half-ripened shoots.

apétala, Labill. Shrub or small tree, 6-15 ft. high, rarely more: lvs. 2-4 in. long, oblong-ovate, obtuse or

POMEGRANATE

subacute, irregularly crenulate; panicles 3-7 in. long, terminal and axillary; calyx-tube short, stellate-tomentose; petals wanting; caps. obtuse, sparsely stellate-tomentose. Austral. and New Zeal.—Cult. in Calif. for ornament. Von Mueller in his "Select Extra-Tropical Plants," says it is "a tree attaining a height occasionally of 60 ft., but mostly smaller. The foliage is devoured with avidity by pasture animals, often in preference to ordinary good feed."

P. saccinifolia, Reiss, an Australian species with ovate or nearly orbicular lvs., cream-colored fls. in ovoid terminal panicles and with broad petals, has been cult. in England. G.C. III. 35:339.

F. TRACY HUBBARD.

POMEGRANATE is the vernacular of *Punica Granatum*, a small tree of southern Asia, grown both for ornament and for its edible fruit (Fig. 3122). See *Punica*. It is somewhat grown in the open in the southern states, and also as a pot- or tub-plant in greenhouses in the North.

The natural habit of the pomegranate is of rather bushy growth, but by careful training a tree 15 to 20 feet may be produced. This, however, seems possible only in the southern sections of the United States. A great many shoots spring from the base of the plant; these should be cut out, as it is contended that they withdraw the nutriment which should go to the fruit-bearing stems. The branches are slender, twiggy, nearly cylindrical, somewhat thorny. The leaves are lanceolate, long, narrow, glossy green and with red veins. The flowers have a red thick fleshy calyx, crowned with bright scarlet crumpled petals and numerous stamens. The fruit is globular, topped with a crown-like calyx, and the interior consists of numerous seeds enveloped in a bright crimson or pink-colored pulp, seeds being arranged in segments, separated by a thin skin, and very acid in the typical variety. A cooling acescent drink, known as granadine, is made from the pulpy seeds, with the addition of water and sugar. This is much used in the South, and in certain parts of Europe, and is especially grateful in fevers. This plant will succeed as far as the 35th degree of latitude north, but during extreme cold periods, the plants are sometimes injured by cold in that latitude. For higher latitudes it should be cultivated in tubs, and given a conservatory during winter. For some sections of the South it is used for hedges. The fruit begins to ripen about September and can be kept for several weeks.

The pomegranate is multiplied by hardwood cuttings planted in open ground during February, or by layers and also by softwood cuttings during summer. As the plant forms many shoots, these are often used, as they usually are provided with rootlets. In Florida, Georgia, Alabama, Louisiana, and some of the other southern states, pomegranates are grown commercially and are shipped to the northern and eastern markets. There is a growing demand for the fruit of the pomegranate.

The pomegranate is supposed to have been introduced into southern Europe by the Carthaginians, whose Latin name of "*Punicus*" was thus given and derived. A reference is also found in the sacred scriptures. Theophrastus described it 300 years before the Christian era, and Pliny considered it one of the most valuable fruits, both as to its beauty and medicinal properties. The bark of the



3122. Pomegranate, in lengthwise section. (× ½)

root is a well-known astringent employed in therapeutics, in dysentery and diarrhea; the rind of the fruit, when boiled, has for many generations past been the remedy for tenia, and a jet-black smooth writing ink is also made of it.

The pomegranate is a native of some parts of Asia, and by some botanical authors is said to be found also in northern Africa and China. Although of such ancient origin and cultivation, there are but few varieties of the fruit-bearing section disseminated in this country and Europe, but, according to Firminger, several fine varieties have been grown in Bengal from seed brought from Cabul, one being seedless, another growing to the size of "an ordinary human head" and still another as large as a small shaddock.

Varieties grown for fruit.

Acid, or Wild.—With a sharp acid pulp: fruit often very large, from 3 to 4 inches diameter and with a bright-colored rind.

Dwarf.—A form of the Acid variety, of very low and bushy growth: flowers single: fruit from 1½–2 inches diameter; pulp very acid. This can be grown in a pot, as it fruits very abundantly.

Paper Shell.—Very large, juicy, very sweet, and of excellent quality; skin thin, pale yellow with crimson cheek; sides crimson: fine grower: good bearer and ships well.

Rhoda.—Fruit crimson, of large size; skin thin but tough; crisp, sweet, and of exquisite flavor.

Spanish Ruby, or Purple-seeded.—As cultivated in Louisiana, seems to be only a form of the Subacid. Fruit large and bright-colored with deep crimson pulp. It is considered the best of its class.

Subacid.—Differs only from the Sweet in the more acidulated pulp.

Sweet.—Fruit usually somewhat smaller than the Acid and with a darker-colored rind; pulp sweet.

Wonderful.—This is said to be the largest of all pomegranates: fruit sometimes 5 inches diameter, bright crimson; pulp highly colored; very juicy; fine flavor: ripens early: good shipper.

All these varieties are very ornamental from their abundant yield of bright scarlet flowers, which are produced upon the extremities of the young branches of the same year's growth. When the plant is grown in a tree form, the branches should be annually cut back after the leaves drop.

Varieties grown for ornament (non-fruiting).

Double Dwarf, or Punica nana racemosa.—Of dwarf growth, with bright scarlet double flowers, which are borne in clusters. This is especially desirable for growing in pots, as its flowers are abundant and lasting.

Double Red.—With a very large calyx, from which protrude numerous large bright scarlet petals, larger than those of the common single type. These are produced in abundance during summer and fall and resemble a bright scarlet pompon.

Double Variegated, or Legrellei.—A very handsome variety with very large flowers, the petals being striped and mottled with yellow and scarlet. Double red blooms will frequently be found on the same stem with variegated blooms. As this is a sport of the Double Red it frequently reverts.

Double Yellow.—Similar to the above in shape of flower, but latter are of a pale yellow color.

Double White.—Form of flower is similar to Double Red, but color is pure white. L. A. BERCKMANS.†

POMELO (contraction of *pomplemoose*?). A name sometimes used in the East Indies for pummelo and in the United States for the grapefruit. Inasmuch as there are very many different varieties of *Citrus grandis*, it seems best to retain pummelo in its common East Indian sense as a generic term for all of them and to

apply to the special form grown in the West Indies and the United States its old name grapefruit. The use of pomelo (a mere variant of pummelo) for the grapefruit is likely to lead to confusion, especially as growers, shippers, dealers, and consumers all continue to use the name grapefruit. See *Pummelo*.

WALTER T. SWINGLE.

POMOLOGY: *Fruit-growing*, page 1290.

POMPLEMOOSE (Dutch, *pomplemoes*, perhaps from Dutch *pompoen*, pumpkin, and old Javanese, *limoes*, a citrous fruit). A name sometimes used in East India instead of the more common pummelo for forms of *Citrus grandis*.

PONCIRUS (French, *poncire*, a kind of citron). *Rutaceæ*, tribe *Citrææ*. Small spiny deciduous tree native to North China, extensively used as a stock for oranges, also grown for hedges and often for ornament in regions too cold to permit of the culture of citrous fruits.

This plant has been usually referred to Citrus, although DeCandolle, Rafinesque, Miquel, Penzig, Hance, Makino, and other botanists referred it to other genera. It differs from Citrus in having deciduous trifoliate lvs.: fl.-buds formed in early summer and passing the winter protected by bud-scales: fls. borne on old wood in early spring and nearly sessile, with petals opening flat and narrowed to a claw-like base;



stamens entirely free; ovary 6–8 (usually 7-) celled: fr. densely and finely pubescent, the pulp vesicles containing oily matter in drops and having hair-like appendages which secrete a viscous fluid, the ovary wall showing orange-colored cellular eruptions between the bases of the pulp vesicles; pith with transverse plates of thick-walled cells; stomata of the green twigs situated at the bottom of deep narrow pits; and seedlings with spirally arranged cataphylls, the lowest bract-like, the uppermost gradually merging into foliage-lvs. In view of these numerous differences, all of them of taxonomic importance, there can be no doubt of the validity of the genus Poncirus.

trifoliata, Raf. (*Citrus trifoliata*, Linn. *Citrus fusca*, Lour. *Pseudople sepia*, Miq. *Pseudople trifoliata*,

Makino. *Eglet septaria*, DC. *Limonia? trichocarpa*, Hance. *Citrus triptera*, (CART.). TRIFOLIATE ORANGE. Figs. 3123-3125. A small tree, spines long and stout: lvs. deciduous, trifoliate, often borne in tufts on old wood (see Fig. 3123); terminal lfts. $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long, lateral ones 1-2 in. long, sessile, petiole slightly winged: fls. $1\frac{1}{4}$ -2 in. across, white, the corolla opening nearly



3124. Flowers of *Poncirus trifoliata*. ($\times \frac{1}{2}$)

flat, and the petals narrowed to a claw at base (Fig. 3124), stamens free, ovary 6-8- (generally 7-) celled: fr. very fragrant, dull lemon-colored, like a small orange in shape, but only $1\frac{1}{2}$ -2 in. diam., and covered with fine downy hairs, oil-glands of peel abundant, filled with a very disagreeably flavored oil, pulp scanty, very aromatic, seeds ovoid, plump, very numerous, leaving little space for pulp. Illus. Kaempfer. Amoen. 801. B.M. 6513. G.C. III. 27:269. Penzig, Studi sugli Agrumi, Atlas, pls. 13, 14. U. S. Dept. Agric. Yearbook 1904, pl. X. U. S. Dept. Agric. B.P.I. Circ. No. 46, figs. 1-6, pl. 1. Comptes rendus 4 me Confer. Internat. Génét, p. 386.—The trifoliolate orange has been known in N. China since ancient times, being repeatedly referred to in early works, and it was described and figured in the Chêng lei pen ts'ao, printed in 1108 A.D. It was early intro. into Japan and definitely referred to in the *Mannyô shû*, a Japanese MSS. work dating from the 8th century. Var. *monströsa*, Swingle (*Citrus trifoliata* var. *monströsa*, T. Ito in Encyclopedia Japonica, 2:1056). HIRYÔ, or FLYING DRAGON. This is a curious, very dwarf variety with tortuous branches and curved spines. The lvs. are very small and inconspicuous as the lfts. are often reduced to mere filaments on which the oil-glands appear as node-like thickenings. This variety is esteemed in Japan for cult. as a dwarfed pot-plant. The writer introduced it from Japan into this country in 1915.

The hybrids between *Poncirus trifoliata* and the common orange are called citranges. A number of varieties, Rusk, Colman, Morton, and so on, are grown for home use in the cotton-belt, north of the limit of successful orange-culture. See *Citrange*. Promising hardy hybrids have been made at the Department of Agriculture under the writer's direction between *P. trifoliata* and a number of other species of citrus fruits, such as the sour orange, mandarin, grapefruit, lemon, lime, calamondin, kumquat (*Fortunella* sp.), and others. These are being tested in the field.

The principal use of the trifoliolate orange is for stock upon which to graft the commonly cultivated citrus fruits. It is especially well adapted to rather rich somewhat moist, sandy loam soils, preferably with a clay subsoil, such as are common around the Gulf Coast. It is not at all adapted to light sandy soils, nor to strongly calcareous soils. Almost all kinds of citrus

fruits grow readily on trifoliolate stock but are dwarfed somewhat and usually forced into early bearing. The Satsuma orange as grown commercially in this country is practically limited to this stock as it does not grow at all on sour orange stock and succeeds only very imperfectly on sweet orange stock. Trifoliolate stock is also very widely used in Japan. In the states south of the Potomac and Ohio rivers the trifoliolate orange is sometimes used for hedges, for which purpose it is well adapted because of its dwarfed habit, strong thorns, handsome flowers, foliage, and fruits. Even in winter after the leaves have fallen its twigs remain green. It is very widely used for hedges in Japan. *P. trifoliata* is also of value as an ornamental tree for lawn planting, for which purpose care should be taken to secure large-flowered forms. It can be grown for this purpose as far north as Philadelphia. The trifoliolate orange shows surprisingly little variation. Millions of seedlings are grown every year in the larger citrus nurseries of this country but it is rare to see any perceptible variation in the character of the leaves and twigs. The flowers, however, do show variation, often having a partial staminody of the petals (rarely complete) which makes them smaller and less handsome than the normal large flowers. The fruits are usually nearly spherical but rarely are somewhat elongate and papillate, much like a very small lemon.

WALTER T. SWINGLE.

POND-APPLE: *Annona glabra*. P. Lily: *Nuphar*. P.-weed: *Polamogon*.

PONGAMIA (a native Malayan name). *Leguminosæ*. A single arborescent or shrubby species of tropical Asia and Australia, little known in this country.

Leaves odd-pinnate; lfts. opposite: fls. racemed; calyx campanulate, nearly truncate; corolla much exerted; standard broad; keel obtuse, the petals cohering at the tip; stamens monadelphous, the upper filament free low down; anthers oblong, versatile; ovary subsessile, 2-ovuled; style incurved, glabrous; stigma capitate: pod flattened, oblong, indehiscent, not at all winged or thickened at the sutures. It is related



3125. *Poncirus trifoliata*.

to *Piscidia* but differs from it by having the pods short, compressed, smooth, and 1-seeded instead of elongated, winged, and several-seeded.

pinnata, W. F. Wight (*Cytisus pinnata*, Linn. *P. glabra*, Vent. *Pongam pinnata*, Wight. *Galedupa indica*, Lam.). A tall erect tree or climber, with glabrous branches and lvs.: lfts. 5-7, opposite, subcoriaceous, oblong or ovate, pointed, stalked, 2-4 in. long: fls. in a simple peduncled axillary raceme, nearly as long as the lvs.; pedicels 2-4 joined together, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, with a pair of minute bractlets in the middle; corolla $\frac{1}{2}$ in. long, standard silky on the back: pod woody, glabrous, $\frac{1}{8}$ - $\frac{1}{4}$ in. thick, $1\frac{1}{2}$ in. long, with a short decurved point. Intro. into U. S. in 1910.—Suitable as an ornamental in the southern states. The ash of the wood is used for dyeing. The seed yields a thick red-brown oil used for illuminating and medicinal purposes. The foliage is bright and very handsome. The tree sometimes reaches a height of 40 ft. Grown in S. Calif.

P. L. RICKER.

PONTERERIA (G. Pontederia was an Italian botanist, 1688-1757). *Pontederiaceae*. Perennial herbs of bogs and ponds with strong horizontal rootstocks, frequently used in water-gardens, and for naturalizing in wet places.

Leaves long-petioled, root-lvs. with a sheathing stipule within the petiole: infl. a 1-lvd. st. bearing a spike of violet-blue ephemeral fls.; perianth funnel-form, 2-lipped, the 3 upper segms. united to form the 3-lobed upper lip, the 3 lower spreading and clawed; stamens 6; ovary 3-celled, 2 of the cells empty.—Two or 3 species from N. and S. Amer.

Pontederias are well worth cultivation in bog-gardens and shallow ponds, and *P. cordata* is offered by dealers in native plants. It thrives best in water 10 to 12 inches deep. It transplants with ease. Propagated mostly by division. It grows as far north as Nova Scotia and Minnesota, and therefore is perfectly hardy in all parts of the country.

cordata, Linn. **PICKEREL-WEED**. Growing in clumps: lvs. heart-shaped, blunt, from a spathe-like bract: upper lobe of perianth marked with a pair of yellow spots (rarely all white); calyx-tube in fr. crested with 6-toothed ridges. Nova Scotia to Ont., Minn., and Texas. B.M. 1156. Mn. 7:1. V. 2:196; 3:336. G.C. III. 52:466. Var. *lanceifolia*, Morong (*P. lanceifolia*, Muhl. *P. lanceolata*, Nutt.), differs from the type in having lanceolate lvs. N. Amer. B.M. 8108.

For *P. crassipes*, Mart., see *Eichhornia crassipes*, Vol. II, p. 1105. —*P. montivensis*, Hort., has appeared in the foreign journals but its botanical characters are unknown. G.W. 3, p. 619.

F. TRACY HUBBARD.

PONTHIEVA (named in honor of M. de Ponthieu). *Orchidaceae*. Terrestrial, glabrous or pilose herbs which are not in common cultivation, though sometimes grown in gardens.

Roots fascicled in a short rhizome: lvs. subradical, ovate or lanceolate, membranaceous, more or less petioled: infl. a lax raceme borne on a simple elongated scape; the pedicels often glandular-pubescent: fls. medium-sized; sepals free, spreading; petals adnate to the column, narrower than the sepals; labellum adnate to the base of the column by a claw, ascending, with the lateral lobes winged; column short or rather long, terete, apex broadened: caps. oblong, erect, beakless.—About 30 species, Trop. and Subtrop. Amer.

glandulosa, R. Br. Plants 1-1 $\frac{1}{2}$ ft. high, with lanceolate-elliptical, pointed and short-petioled lvs. which are 3-5 in. long: raceme 3-6 in. long; fls. green or greenish brown; outer sepal ovate-oblong, lateral ones flat; petals half-cordate-deltoid; labellum abruptly dilated above the claw, roundish with a terminal, linear appendage. W. Indies and S. Amer. B.M. 842 (as *Neottia glandulosa*).—Formerly offered by a dealer in native plants. Probably not hardy N. F. TRACY HUBBARD.

POPCORN: *Corn*.

POPLAR: *Populus*. P., Yellow: *Liriodendron*.

POPPY: *Papaver*. California P.: *Echscholzia*. Celandine P.: *Stylophorum*. Corn P.: *Papaver Rhoeas*. Horned P.: *Glaucium*. Opium P.: *Papaver somniferum*. Prickly P.: *Argemone*. Shirley P.: an improved strain of *Papaver Rhoeas*. Tulip P.: *Hunnemannia*. Welsh P.: *Meconopsis cambrica*.

PÓPULUS (ancient Latin name, of disputed origin). *Salicaceae*. **POPLAR**. **ASPEN**. **COTTONWOOD**. Soft-wooded trees of rapid growth, some kinds of which are much planted on roadsides and in grounds, particularly when quick results are desired.

The poplars are dioecious, with both staminate and pistillate flowers naked but from a cup-shaped disk, and in slender mostly drooping precocious catkins in which the subtending scales are toothed, cut or cleft at the apex: stamens few or many, usually numerous, on distinct filaments: pistillate fls. with mostly a single 1-loculed mostly sessile ovary with short style and 2-4 often lobed long stigmas: fr. a small 2-4-valved caps., containing cottony seeds, the mature catkin sometimes with a necklace-like or moniliform character: lvs. alternate, stalked, mostly broad: buds scaly, often resinous.—Species probably about 35-40, in the northern hemisphere, mostly extra-tropical, although very many more than this have been described, some of them being hybrids. The poplar of lumbermen is the tulip tree. (See *Liriodendron*.)

Botanically the poplars comprise a most bewildering group, and there is wide divergence of opinion and practice as to the limits and names of species. Many of the cultivated forms are assumed to be hybrids, but the origin of most of them, so far as parentage is concerned, can be little more than conjectured. It is likely that seedlings of some of these hybrids break up into forms much resembling the parents, and thereby still further contribute to the bewilderment. The trees being dioecious, the herbarium specimens may not represent both sexes; as the catkins appear in advance of the foliage, the specimens may not represent the same plant or type; the foliage is very various, sometimes even on the same tree, and specimens are likely to be taken from the lower part of large trees where the leaves are small or from the terminal shoots of young trees on which the leaves are large and have a different character. Of some kinds only one sex is known. The habit of growth is also very characteristic even in species or forms on which the foliage is very similar, but this character is of course not represented in botanical specimens. It will be seen, therefore, that the usual herbarium collection may not have full value in the determination of species. There is naturally a tendency to place great stress on leaf-forms in the description of species, even though in some groups practically the whole range of forms may be found on single trees. These difficulties are particularly marked in this country in the *P. deltoides-angulata* group.

With regard to the variability of the leaves of *Populus*, Schneider writes in "Plantæ Wilsonianæ": "it is helpful to keep the following in mind. L. A. Dode was the first who clearly described the variation of the leaves according to the age of the plants, the position of the branches, and the climatic and other conditions under which they were produced. . . . I think it sufficient if we distinguish three different kinds of leaves: (1) the leaves of the offshoots or suckers (*folia turionum radicalium*); (2) the leaves of the normal but not the vigorous shoots of the young plants (*folia ramorum* [sed non *turionum*] *plantæ juvenilis*); and (3) the leaves of the old trees (*folia arboris adultæ fructiferæ*). The leaves of the third kind we usually find at the ends of vigorous branches of young plants when they are growing well and becoming mature. If we compare leaves of different species it is necessary to be very careful only to compare the same kinds of leaves."

What has been said about the dependence on leaf-characters in descriptions applies also to the horticultural description; it is much needed that the cultivated poplars shall be studied with the purpose to correlate the characters of habit, leaves, buds, twigs, bark, flowers, and fruit.

Probably some of the difficulty in distinguishing native species of *Populus* is due to the fact that we have not recognized the presence of European or other hybrids in this country. It is not unlikely that some of these forms appear even in places remote from habitations, as do the introduced tree willows, and that they have been confused with the native kinds.

There appear to be few important growing collections of poplars in this country, nor have the important cultivated examples in different parts been looked up and studied. Many of the European nursery forms have been introduced here and there; but for ornamental planting practically only two kinds are much called for, the Lombardy and the so-called Carolina, with "Russian poplars" and "Norway poplars" in the prairie and plains country. This is a pity, seeing that some of the forms are most interesting in habit and foliage, and in the red coloring of petioles and midribs, combined with other good features. The hybrid poplars have not been given sufficient attention in North America. Some of the first-generation hybrids are remarkably vigorous. The Russian poplars are undoubtedly of several kinds, mostly, apparently, forms or hybrids of *P. balsamifera* allies. A very large collection of Asiatic poplars was made at the botanic gardens at St. Petersburg and also at the agricultural college at Moscow. The late J. L. Budd introduced many of these forms and they have become widely distributed in the prairie regions. It would not be strange if substitutions had been made in the course of time.

The Norway poplar of the interior region is very like *P. Sargentii* in foliage, but it holds its leaves three weeks later in autumn than the native cottonwood and the central trunk does not break up so quickly, thereby making a better timber tree; it is a very rapid grower. It has proved to be a very valuable tree for Minnesota and the Dakotas and other parts, and is hardy in Manitoba. On account of its very rapid growth and the straight strong trunk, it has been called the "Sudden Sawlog poplar." It appears to have been introduced into North America from Russia by Budd, and is said to have been discovered on the eastern slope of the Altai Mountains. It was disseminated in part in this country by Norwegian settlers and thereby got the name of Norway poplar. Its botanical position or name is undetermined.

Poplars of various kinds are considerably planted on the prairies and plains and form characteristic features on the landscape. Many of them withstand the trying climatic conditions and also grow very rapidly. The many kinds of cultivated poplars, which have been

largely introduced or tried in these regions, stretching into Canada, need careful study by the systematist. They are particularly numerous in the *tacamahac* or *balsam-poplar* group and are not well understood. In the irrigated regions of the Rocky Mountain country, the Lombardy poplar has long been a familiar object along ditches and thoroughfares.

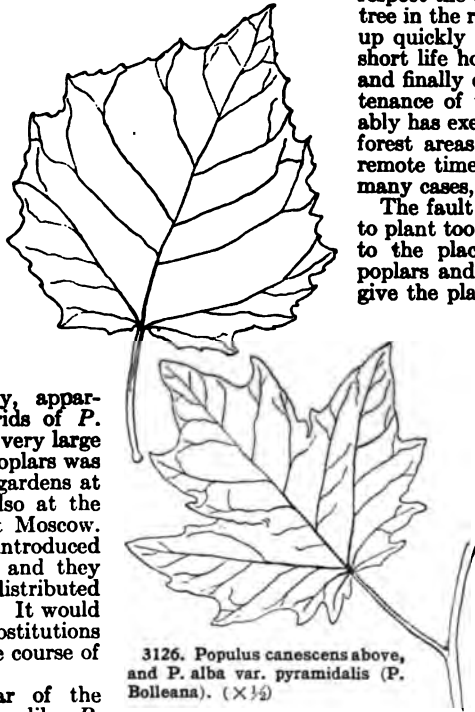
The poplars are amongst the easiest of all trees to propagate and to grow. They come readily from hardwood cuttings, as do willows and currants. The weeping varieties are grafted head-high on erect kinds, *P. grandidentata* or its derivatives apparently being used as a stock. Poplars thrive in almost any soil, although the cottonwood is most at home in lowlands and along streams, at least in the East. For shelter-belts they are very useful because of rapid growth and great hardiness. In Europe, where fagots and other similar materials are desired, poplars are often headed-back severely or pollarded, but this practice is very little known in North America. The poplars are also useful for temporary shelter for other trees and bushes. In this respect the common aspen (*P. tremuloides*) is a valuable tree in the reforestation of American lands. It springs up quickly in clearings, and during its comparatively short life holds the soil and protects other vegetation and finally contributes its own substance to the maintenance of the stronger forests. In this way it probably has exerted an effect upon the configuration of our forest areas and upon the fertility of the land from remote time. The same qualities make it valuable, in many cases, in extensive ornamental plantings.

The fault in the planting of poplars is the tendency to plant too many and to allow them to give character to the place. About summer resorts, for example, poplars and willows are used much too freely. They give the place a look of cheapness and temporariness.

They are planted in such places because they grow rapidly and thrive in unfavorable conditions; but it is better to use them for temporary effects, allowing better trees, that are planted with them, gradually to take their places. The legitimate common use of poplars in ornamental grounds is the production of minor or secondary effects. As a rule, they are less adapted to isolated planting as specimen trees than to use in composition,—as parts of general groups of trees,—where their characters will serve to break the monotony of heavier foliage. The poplars are "gay" trees, as a rule, especially those, like the aspens, that have a trembling foliage. Their leaves are bright and the tops thin. A few of them in judicious positions give a place a sprightly air. This is particularly true of the common aspen, *P. tremuloides*, of the woods. Its light twinkling foliage and silver-gray limbs are always cheering and its autumn color is one of the purest golden yellows of our landscapes. It is well to have a tree of it standing in front of a group of maples or evergreens. Its whole expression is then one of familiarity.

On the other hand, the poplars have their interest as specimen trees as distinctly as do other kinds of trees, but one seldom sees well-grown mature examples. The age characters of some kinds of poplars, both in structure and in bark, are as interesting as are those of maples and oaks or other trees. Of many of the planted poplars, old specimens are practically unknown to the public.

The cottonwood (*P. deltoides*) is one of the best poplars for permanent planting. It makes a noble tree, of durable and substantial appearance. But like the aspen, it is cheerful and restive. One is not moved to lie under it, as one is under a maple or an oak. Its leaves



3126. *Populus canescens* above, and *P. alba* var. *pyramidalis* (*P. Bolleana*). (× 1/2)

rustle with the lightest movement of air. The ripple of its foliage recalls the play of wavelets on a pebbly shore. The day is never so dark but the cottonwood reflects a flood of light. One should take care, however, to plant only the staminate tree, for the "cotton" of the seeds is very disagreeable on lawns and about dwellings when carried by the wind. In the plains and mountain states, the western cottonwood (*P. Sargentii*) is a characteristic tree.

Some of the forms of the black poplar of Europe are especially satisfactory for the production of lively effects in planting. Of these, one of the most distinct is the form known to nurserymen as *Populus elegans*. It has a most pleasing light and tremulous foliage, the effect of which is heightened by a twiggy character of growth and a reddish cast to the leaf-stalks and young shoots. It is an elegant tree, and well adapted to planting in front of heavier foliage in the most conspicuous part of the grounds.

Some of the silver- or white-leaved poplars produce the most striking contrasts of foliage, especially if set near darker trees. Bolles' poplar (*Populus Bolleana* of the nurseries) is one of the best of these trees. Its habit is something like that of the Lombardy. The upper surface of the deeply lobed leaves is dark dull green, while the under surface is almost snowy white. Such emphatic trees as this should usually be partially obscured by planting them amongst other trees so that they appear to mix with the other foliage, or else they should be seen at some distance. Other varieties



3127. *Populus tremula*. (× 1/4)

of the common white poplar or abele are frequently useful, although most of them sprout badly and may become a nuisance. The Lombardy poplar (*P. nigra* var. *italica*) is probably the most striking and distinct tree that is suited to planting in the North. As single specimens scattered here and there in mixed plantings, or when seen over or behind buildings, it may be most picturesque and satisfactory; but the tendency is to plant it too freely. The very fact that it is emphatic is the reason why it should be planted sparingly when artistic effects are desired.

The catkins of poplars, particularly the staminate ones, are usually attractive, as they appear in early spring; but they are of short duration. Fig. 3130.

The following sketch includes all the poplars known to be offered by American nurserymen or to be subjects of rather general planting, together with exotic forms that are likely to appear in this country. For literature, see Wesmæel, DC. Prodr. 16, pt. 2, pp. 323-31; Sargent, Silva of North America, vol. 9 (quoted below as S.S.). A very recent careful treatment of the poplars appears in Volume VII of Elwes & Henry, "Trees of Great Britain and Ireland;" from this work some of the following characterization is drawn. Subsequently, the black poplars (*P. nigra-deltoides* group) have been worked over by Henry in Transactions of the Royal Scottish Arboricultural Society, 30, pt. 1.

Discussions of the genus of recent date will be found in C. K. Schneider, "Handbuch der Laubholzkunde" (1906) and Dode in Mémoires Société d'Histoire Naturelle d'Autun (1905). For an account of the new and old Chinese species, see Schneider in "Plantæ Wilsonianæ," Vol. III.

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For the purposes of this popular treatment, the species of *Populus* may be thrown into six groups:

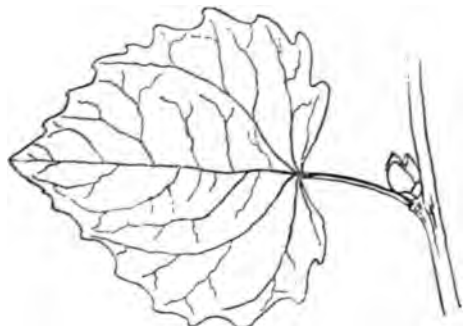
- I. The white poplars; Nos. 1-3.
- II. The aspens; Nos. 4-7.
- III. The black poplars and cottonwoods; Nos. 8-14.
- IV. The large-leaved poplars and cottonwoods; Nos. 15, 16.
- V. The balsam poplars and tacamahacs; Nos. 17-28.
- VI. The variable-leaved poplars; No. 29.

I. WHITE POPLARS. *Lvs.* mostly strongly angled or lobed and broader than ovate in shape, the mature *lvs.* on the long or verdurous shoots usually white-tomentose or gray-canescens beneath (at least in the cult. forms). *lvs.* on the short or small shoots often becoming glabrous or nearly so and often of different shape from those on the strong-growing shoots; petiole usually cylindrical; terminal buds relatively small and not glutinous.

1. *Alba*, Linn. (*P. triloba* and *P. Morissetiana*, Dode). WHITE POPLAR. ABLE. Large much-branched tree, with whitish bark on the young branches becoming dark-colored and rough on the mature parts: *lvs.* much like those of *P. grandidentata* in form, but smaller, usually thicker and more angular, the under surface—especially early in the season—woolly white, in shape from broadly ovate to orbicular, irregularly short-lobed or sinuate, short-truncate or somewhat cordate at base: catkins short (mostly about 2 in. long, the males longer), sessile, with thin dentate or erose scales; stamens 6-10; stigma linear-lobed. Eu. and

Asia.—The typical form of *P. alba* is less grown here than the varieties with lobed and very white-bottomed (and sometimes variegated) lvs. In old places and yards it is sometimes found, but var. *nivea* and in newer grounds var. *pyramidalis* are more frequent. Var. *globosa*, Spæth. Dense small tree or shrub, oval in outline of head: lvs. small, deltoid-cordate, slightly lobed, gray beneath and pinkish when young. Of horticultural origin. Var. *pendula*, Loud. Branchlets drooping: Var. *Richardii*, Hort. Lvs. yellow on upper surface.

Var. *nivea*, Wesm. (*P. nivea*, Willd. *P. argentea*, Hort. *P. arebergiana*, Hort.). This is the commonest form of white poplar in this country. It is known by the



3128. *Populus tremula* var. *pseudograndidentata*. (× ¼)

snow-white under surfaces of its foliage and the 3- or 5-lobed maple-like lvs. It is far too frequent about old yards, where its inveterate brood of suckers make it a perpetual nuisance. It is sometimes called "silver maple," from the resemblance of its foliage to that of the maple. As a street tree in cities it is particularly offensive, for the cottony covering of the under side of the leaves and of the shoots holds soot and dust, and it looks repulsively dirty. Useful for foliage effects in large plantings.

Var. *subintegerrima*, Lange (*P. subintegerrima*, Dode. *P. monticola*, Brandege. *P. Brändegeei*, Schneid.). Lvs. coriaceous, those on the long shoots ovate or orbicular, somewhat cordate or cuneate at base, nearly entire to somewhat toothed, white underneath; those on short shoots nearly circular, entire or slightly sinuate, gray underneath. Spain, N. Afr. Early intro. into Mex. and apparently naturalized in Low. Calif. G.F. 4:330; 6:190; 7:313 (deses.).

Var. *pyramidalis*, Bunge (*P. Bolleana*, Carr. *P. alba* var. *Bolleana*, Lauche). BOLLE'S POPLAR. Fig. 3126. A very tall narrow-topped tree, with cottony lvs. rather more deeply lobed (palmately 3-5-lobed) than those of var. *nivea*, those on the short shoots circular, coarsely triangular-toothed. The tree was intro. into Eu. from Asia in 1872 from Turkestan, and it was named for Dr. C. Bolle, an arboriculturist. It bears about the same relation to *P. alba* that the Lombardy poplar bears to *P. nigra*. Its fastigate habit, combined with the white foliage and shoots, makes it a most emphatic tree, and there is great danger of planting it too freely. It is said to be much attacked by borers.

2. *canescens*, Smith (*P. alba* var. *canescens*, Ait. *P. megaleuca*, Dode. *P. hybrida*, Reichb. *P. Steiniâna*, Bornm.). GRAY POPLAR. Fig. 3126. Lvs. broad or nearly circular in general outline, prominently notched but not lobed, the under surfaces and the young shoots very gray-woolly, those on young or long shoots ovate-deltoid, cordate and acute, grayish tomentose beneath, the margin few-toothed and ciliate; those on short shoots nearly circular or broad-ovate, subcordate and obtuse, not ciliate, the lower surface light green. Var. *pendula*, Hort., is a fine form with pendulous

branches. This tree is met with occasionally. Its horticultural value is not greatly different from that of *P. alba* var. *nivea*. According to Elwes & Henry, *P. Boqueana*, Dode, is a vigorous form of this species in which the lvs. on long shoots are 5 in. or more in length and breadth; appears to be sold by some nurserymen abroad as *P. tomentosa*. Forms of this species are probably hybrids with *P. tremula*. Eu.

3. *tomentosa*, Carr. (*P. alba* var. *tomentosa*, Wesm. *P. alba* var. *denudata*, Maxim. *P. pekinensis*, L. Henry. *P. glabrata*, Dode). WHITE POPLAR of China. Large tree, similar to *P. alba*: lvs. thick, on long shoots of mature trees large (4-6 in. long), triangular-ovate, not lobed, the broad base truncate or subcordate, acuminate, margin sparingly sinuate-toothed, shining dark green above and glabrescent beneath; on short shoots small, ovate or triangular, cuneate, sinuate-toothed, glabrous beneath; on vigorous shoots white-tomentose beneath. N. China, where it makes a large tree, and is planted in temple gardens; the restless lvs. suggest the sound of falling rain. R.H. 1903, p. 355.—Hardy in Mass., but is said not to prop. from cuttings.

II. ASPENS. Lvs. not lobed, broader-based than ovate-form; mature lvs. green or at least not white-tomentose, glabrous or nearly so beneath, those on strong-growing and short shoots not prominently different; petiole usually distinctly flattened; terminal buds not large or glutinous: trees of small or intermediate stature, usually with trembling foliage.

4. *tremula*, Linn. EUROPEAN ASPEN. Fig. 3127. Open-headed light-lvd. tree, becoming 50-60 ft. tall, but mostly small and of relatively slow growth, producing suckers: lvs. small and thin, round-oval, more or less whitened beneath when young, bordered with deep and rounded incurved teeth; lf.-stalks long, slender and flattened, giving a restless motion to the foliage; lf.-buds small; catkins small, with hairy scales and stigma deeply divided; stamens usually 6-8. Widely distributed in Eu. and Asia, in this country known chiefly in its grafted weeping form (var. *pendula*, Hort.). The eastern Asiatic and Chinese form is made var. *Davidiana* by Schneider: always a slender tree, rarely exceeding about 60 ft.: young lvs. reddish purple and handsome as they unfold; suckers freely: there is a pubescent form of this variety.—The drooping form of the European aspen is perhaps the best weeping tree amongst the poplars. The spray is light, airy, and fountain-like, quite unlike the more common weeping forms of the native *P. grandidentata*, which present a stiff angular



3129. *Populus tremuloides*. (× ½)

form, a combination that is rarely pleasing. A characteristic feature of this tree is the profusion of its very long catkins that appear in earliest spring, even before our native poplars are in bloom. The staminate or male catkins are particularly pleasing, and planters should choose that sex, if possible. Var. *pyramidalis*, Hort., is a slender pyramidal form. Var. *Frœynii*, Herv. Lvs. rhombic in outline, cuneate at base, ciliate, pubescent beneath when young. France, Germany. Var. *villôsa*, Wesm. Hairy on young growths. Var. *pseudograndidentata*, Aschers. & Graebn., see description under No. 5. *P. adenopoda*,

Maxim. (*P. tremula* var. *adenópoda*, Burkill. *P. Silvestrii*, Pampan.), is a recent Cent. Chinese species (allied to *P. tremula*) not in the trade: lvs. long-stalked, broad-ovate, long-acuminate, serrate, soft-pubescent at least on young trees, those on old mature trees closely crenate, greenish beneath. It is growing at the Arnold Arboretum and in the Rochester parks, where it is doing well.

5. *grandidentata*, Michx. LARGE-TOOTHED ASPEN. Tall straight tree, becoming 75 ft. high, with brittle wood and dull gray bark which with age is marked by plates but scarcely by ridges: lvs. roundish ovate, at the apex blunt or gradually narrowed and acute, with large irregular sinuate teeth, white-woolly when young but becoming glabrous: catkin-scales 5-6-divided: fr. slender, long-pedicelled. Distinguished from *P. tremula* by much larger and thicker lvs., which are bluish or rusty white beneath, more ovate in outline, with larger and more spreading teeth, stouter lf.-stalks and larger lf.-buds. Nova Scotia to Minn., Tenn., and N. C. S.S. 9:488.—The lf.-form is variable and botanical varieties have been made from them. In its normal or erect form it is rarely cult., but the weeping kinds, under a variety of names, are frequently seen. Most, and perhaps all, of these varieties originated in Eu., where the tree, like the cottonwood and the common aspen, were early intro. The winter twigs of the weeping varieties have a characteristic weak or zigzag growth. These weeping forms are very likely hybrids, sometimes distinguished as *P. tremula* var. *pseudograndidentata*, Aschers. & Graebn. (*P. pseudograndidentata*, Dode). Fig. 3128. Buds at maturity short, thick and somewhat viscid: lvs. much like those of *P. tremula* but larger, 3-4 in. diam., thicker, the margin with cartilaginous edge at maturity. The forms known as *P. græca pendula* and Parasol de St. Julien are by some referred to *P. tremuloides*, but these names have been applied in this country at least to plants of the above series. The *P. græca* of authors is confused. *P. grandidentata* is a common tree in the E. U. S., growing under a variety of conditions, as on dryish banks and slopes and near swamps and streams.

6. *tremuloides*, Michx. AMERICAN ASPEN. Fig. 3129. Small weak tree, abundant northward and springing up in clearings: lvs. small, roundish ovate with a slightly tapering or a truncate or sometimes even a semi-cordate base, abruptly contracted to a short usually apiculate point, finely crenate-serrate, downy when young but becoming smooth on both surfaces, the petioles long and slender so that the foliage twinkles in the slightest breeze: catkins drooping, with silky deeply 3-5-cleft scales or bracts, the pistillate becoming 3-4 in. long: caps. oblong-conical, not hairy or pubescent: the species is very like *P. tremula*, but the lvs. are

usually less circular and more abruptly acuminate, the margins are small-crenate rather than deeply toothed, and the lvs. are green on the under side. Generally distributed in N. Amer., north of Pa., and Ky., and extending to Mex. in the mountains. S.S. 9:487.—The bark of the young trees is whitish gray, rendering the saplings very conspicuous in a coppice. In woods the tree is said sometimes to reach a height of 100 ft., but it is usually much smaller than this.

The far western form has been separated as var. *aurea*, Daniels (*P. aurea*, Tidest.). Several lf.-varieties have been described. Var. *pendula*, Schneid., is a drooping or weeping form. *P. cercidiphylloides*, Brit., is a form or a closely related species in Wyoming with small entire or undulate lvs. which bear a peculiar concave gland on the blade on either side of the petiole attachment. *P. atheniensis* is an old name said to have been given from a N.



3131. *Populus Sieboldii*. (×¼)

American Athens, and as it is a very early name it is used by Koch in place of *P. tremuloides*. The *P. græca*, of some authors perhaps applies to this species through some error; see No. 5. The name *P. græca* appears to have originated with Aiton, who apparently gave the name because he found it cult. as the "Athenian poplar;" it is probably the same as *P. atheniensis*, Ludw.

7. *Sieboldii*, Miq. Fig. 3131. Tree, 20-30 ft., of spreading habit, suckering freely, with rather dark and heavy foliage: lvs. large, round-ovate, with a short triangular subacute apex, at the base truncate or gradually narrowed into a short petiole, dentate-serrate, with shallow glandular-incurved teeth, more or less whitened beneath. Japan; the wood used for matches and the tree less abundant than formerly.—Hardy in W. N. Y. Said by Wilson to be a tree of medium size in Japan, very like *P. tremula* in general appearance, and suckers freely. *P. rotundifolia*, Griff. (*P. microcarpa*, Hook. f.), is very similar, but the lvs. of old branches are more or less cordate at base: lvs. 3-4 in. across, long-petioled, orbicular, sinuate: fruiting catkins 3-5 in. long and very slender, with a tomentose rachis: caps. only ½ in. long, with a very short pedicel. Himalaya region; probably not in cult. in this country. *P. rotundifolia* var. *Ducoulouxiæna*, Gombocz. (*P. Ducoulouxiæna*, Dode. *P. macranthela*, Lev.), of S. W. China, has still longer fruiting catkins (6-10 in. long) and longer-pedicelled caps.



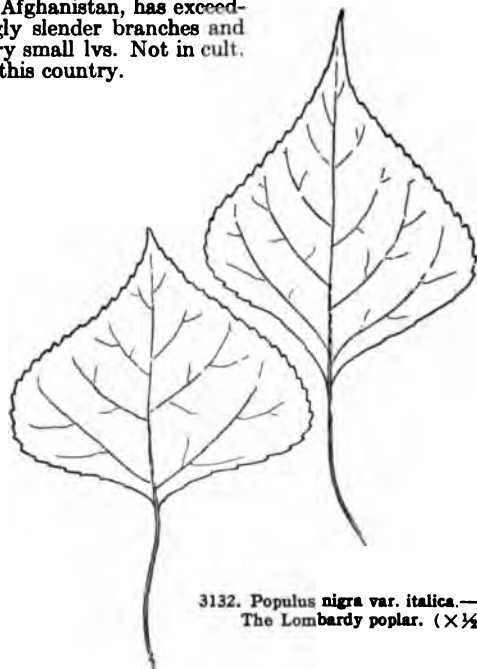
3130. Staminate catkins of an aspen. (×¼)

III. BLACK POPLARS AND COTTONWOODS. Lvs. not lobed, mostly wider and broader-based than ovate in form; mature lvs. hard or firm in texture, green on both surfaces, mostly with a clearly marked translucent or hyaline edge (which may appear as a thin indurated line in the dried specimen); petiole commonly flattened, at least toward the blade: terminal buds medium-large and more or less viscid, but not markedly odorous: mostly large trees.

A. Lf.-margins not ciliate.

8. *nigra*, Linn. BLACK POPLAR. Tree of medium to large size, with smooth twigs and lvs. somewhat resembling those of the cottonwood, but generally smaller and much less deeply toothed, longer in proportion to their width and often with a tapering or rounded base, with no cilia or hairs on margin and no basal glands; lf.-stalk much flattened, so that the foliage moves freely in the wind: stamens 12-25; stigmas and

placentæ 2. Eu., Siberia.—The tree usually has a pyramidal habit of growth and a dark cast to the foliage. It is a less lustrous tree than the cottonwood and grows more slowly. Var. *betulifolia*, Torr. (*P. betulifolia*, Pursh. *P. hudsonica*, Michx. *P. nigra* var. *hudsonica*, Schneid.), has the young growth and the petioles downy. B.M. 8298. Specimens of this plant were found along the Hudson by Michaux, who thought it an American species and published it early in the century as *Populus hudsonica*. Pursh, in 1814, published it again as the "birch-leaved poplar," *Populus betulifolia*, from trees found near Lake Ontario. Although it was found half wild in N. Y. about a century ago, it does not appear to have increased itself in Amer., and the variety is probably of European origin. *P. nigra* is rarely seen, even in cult. grounds. It is sometimes spontaneous in the E. Variable in cult. and grown in European collections under a variety of names. With the exception of var. *italica*, these forms are little known in this country. *P. vidualis*, Dode, is a form of moderately strong growth; branches spreading: lvs. rhomboidal, dark green. The two main forms or types of the black poplar are the glabrous or smooth (var. *typica*, Schneid.), S. Eu., and the pubescent (var. *betulifolia*). The English or downy black poplar makes a wide-spreading attractive large tree, and forms great burs on its trunk. Var. *elegans*, Bailey (*P. elegans* of nurserymen, and probably some one of the well-known European forms), is a tree of pronounced strict or pyramidal habit, but considerably broader than the Lombardy poplar, with thinly pubescent twigs and petioles: foliage small and light-colored and very versatile in a breeze, with a handsome reddish tint to the lf.-stalks and young shoots. It is worth growing in every well-kept place, especially if placed against a planting of heavier foliage. *Populus canescens* of some American nurserymen (not of botanists) is very like this, although it has less color and brightness. *P. charkowiensis*, Schroed., is probably a hybrid in this group, by some supposed to be Lombardy poplar \times *P. nigra*; apparently allied to *P. Eugenei*. Var. *Vialdi*, Aschers. & Graebn. Tree narrow-pyramidal with ascending branches: lvs. like those of *P. nigra* but more cuspidate. *P. afghanica*, Schneid. (*P. nigra* var. *afghanica*, Aitch. & Hemsl.), of Afghanistan, has exceedingly slender branches and very small lvs. Not in cult. in this country.



3132. *Populus nigra* var. *italica*.—
The Lombardy poplar. ($\times \frac{1}{2}$)

Var. *italica*, Du Roi (var. *pyramidalis*, Spach. *P. italica*, Moench. *P. dilatata*, Ait. *P. fastigiata*, Poir. *P. pyramidalis*, Borkh. *P. pyramidalis*, Moench. *P. sinensis*, Dode). LOMBARDY or ITALIAN POPLAR. Figs. 3132, 3133. Differs from the typical black poplar (*P. nigra*) in its tall narrow growth, glabrous young shoots, a confirmed habit of suckering from the root and generally a more tapering base to the lvs.: buds small: lower branches of the head taking a strong upward direction so that it has no hanging or drooping spray; holds its green foliage late in autumn. It is a staminate sport from *P. nigra* var. *typica*, originating in the plains of Lombardy about 1700–20 and now widely spread over the world by means of cuttings. Pistillate Lombardies have been reported but they are of different origin and are usually broader-headed trees. With age, the Lombardy poplar becomes one of the most striking and picturesque trees, particularly when some of the sprouts are allowed to grow about the old stock, as in Fig. 3133. In the northernmost states it is not long-lived. *P. thevestina*, Dode, from Morocco, is apparently a form of the Lombardy poplar type with whitish or gray bark: tree very large: lvs. very large, almost triangular, toothed, shining, with carmine petioles.



3133. An old clump of Lombardy poplar.

Var. *plantierensis*, Schneid. (*P. plantierensis*, Dode). Similar to Lombardy poplar but with reddish pubescent petioles and short-pubescent branchlets. Of horticultural origin, in the nursery of Simon-Louis at Plantières, near Metz, France. This is the fastigate form of *P. nigra* var. *betulifolia*; probably not in commerce in this country. Both sexes are known.

AA. Lf.-margins more or less distinctly ciliate.

9. *Fremontii*, Wats. WESTERN COTTONWOOD. Large tree with trunk sometimes 5–6 ft. diam., very large head of stout spreading somewhat pendulous branches, and bark on mature trunks deeply and broadly ridged: lvs. deltoid or roundish (on young shoots reniform or rhombic), broader than long, with a broad acute apex or sometimes even rounded at apex, cuneate or truncate at base, coarsely irregularly serrate with incurved gland-tipped teeth, thick, firm and shining at maturity, 2–3 in. long; petiole to $2\frac{1}{2}$ in. long and often pubescent; glands absent at base of lf.: catkins $1\frac{1}{2}$ –4 in. long, the pistillate fls. on short pedicels and with thin brown filiform-lobed scales; stamens 50–70: caps. ovate, to $1\frac{1}{2}$ in. long. Banks of streams. W. Texas, S. Colo., Utah, Nev., Calif. S.S. 9:496.

10. *Wislizenii*, Sarg. (*P. Fremontii* var. (?) *Wislizenii*, Wats.). VALLEY COTTONWOOD of the Rio Grande Valley, W. Texas, New Mex., and adjacent parts of Mex., differing in having slender-pedicelled pistillate fls.: lvs. deltoid, sharply acuminate, truncate or slightly cuneate at base: pistillate catkins very slender (2–6 in. long). S.S. 14:732.—A similar tree of Mex., where it is also often planted for shade (and to be looked for in

New Mex., Ariz. and S. Calif.), is *P. mexicana*, Weism. (*P. MacDougalii*, Rose): a tall tree, sometimes 80 ft.: lvs. longer-pointed, the petioles not flattened: fls. shorter-stalked than in *P. Wislizenii* and longer than in *P. Fremontii*: caps. $\frac{1}{4}$ – $\frac{1}{2}$ in. long: it is closely related to *P. Fremontii*, differing chiefly in the larger disk of

the pistillate fls., in the rhombic lvs. of the young shoots and which often appear with the deltoid lvs. on old shoots. S.S. 14:71.

11. *deltoides*, Marsh. (*P. deltoides*, Auth.). SOUTHERN COTTONWOOD. CAROLINA POP-

LAR. Large native tree with deeply furrowed or ridged dark-colored or gray-brown bark in mature specimens, and a deliquescent habit (top breaking up into many strong branches of about equal importance), the branches wide-spreading and the top relatively thin and open: branchlets usually terete except on very strong shoots: lvs.

large, triangular-ovate, very broad in proportion to their length, mostly truncate or nearly straight on the base, abruptly acuminate, coarsely crenate-dentate with mostly curved sinuses, but the margin plane or flat, the petiole long, much flattened near the blade and commonly with 2 or 3 glands at the top, the stipules small and falling early: catkins long and loosely fld., the scales large, dilated at apex and filiform-lobed; stamens 40–60; stigmas and placenta 3 or 4: fr. an ovoid acute caps. Generally distributed from Que. to the plains region and south to Md. and possibly farther. S.S. 9:494, 495.—A variable group; although familiarly known, the specific characters are not clearly defined. The species takes on somewhat unlike forms in the S. and N. and W. Marshall meant to designate the southern form, which has the following characters (*P. deltoides* var. *missouriensis*, Henry. *P. angulata*, Auth., not Ait. *P. deltoides* var. *angulata*, Sarg.): twigs angled: lvs. deltoid-ovate, 5–6 in. wide and about the same length, at the base shallowly cordate or truncate, at the apex short-acuminate and cuspidate, when young and even to midsummer pubescent on both surfaces and petiole; margins sinuate-dentate, the teeth few and coarse and with incurved tips; basal glands 3 or 4. S. E. U. S. and in the Mississippi Valley, from Mo. southward.

Var. *monilifera*, Henry (as *P. deltoides* var. *monilifera*, *P. monilifera*, Ait.). NORTHERN COTTONWOOD. Figs. 3134–3137. Twigs usually not angled: lvs. smaller, on average normal shoots about 3–4 in. wide and of similar length, glabrous on both surfaces and petiole (or only a few evanescent hairs along midrib

and nerves), the basal glands usually 2. Canada to Pa. and probably farther south.

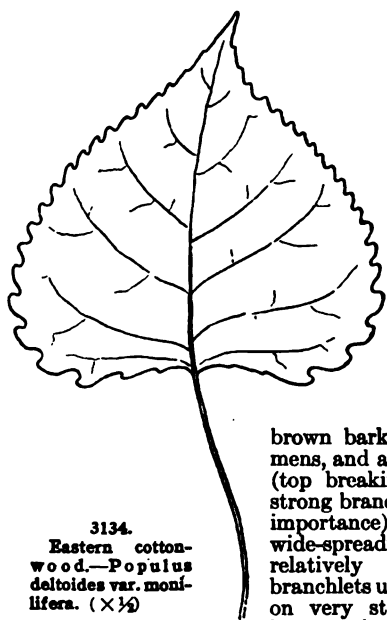
Some of the cult. forms of this group are fairly distinct in foliage and aspect, and they appear to be associated with particular horticultural names in the nurseries. A golden-lvd. tree is known as var. *Van Geertii* or var. *aurea* (really a form of *P. serotina*). This is one of the best of yellow-lvd. trees, and generally holds its color throughout the season. Like all trees of this unusual character, it should be used cautiously, and the best effects are obtained when it is planted against a group of trees so as to appear as if naturally projecting from the other foliage. Some of the most ornamental specimens of cottonwood are those with reddish lf.-stalks and midribs. Taking all things into consideration, the cottonwood is one of the best of the poplars for general ornamental planting. It grows rapidly and in almost every soil, and yet it possesses elements of strength and durability which most of the poplars lack. Its foliage is always bright and glossy, and the constant movement of the broad rich green lvs. gives it an air of cheeriness which few trees possess.

This tree or *P. Sargentii* has been much used on the prairies and in western towns, much too abundantly for good landscape effects. The rapid growth of the tree gives a feeling of luxuriance to plantations even when most other trees appear to be weak or starved. The cottonwood thrives best on rather low lands, and yet it is generally an admirable tree for high and drier areas. Spontaneous forms of introduced hybrids have probably been confused with *P. deltoides*, obscuring the definition of the species, as, particularly, *P. Eugenei* and *P. angulata*.

A poplar in Mont. and Idaho allied to this species has been provisionally referred to *P. Besseyana*, Dode (Bull. Torr. Club, 39:302). The lf.-bases are rounded or subcuneate and more or less serrate; glands small; petioles flattened. "In *P. Sargentii*, the lvs. are flabelate-cordate, with an open concave sinus at base, which is toothless. The lvs. much resemble *P. acuminata* but are broader and less cuneate at the base, and in the latter species the petioles are terete." It is probable, however, that *P. Besseyana*, Dode, is *P. angulata*, Ait.

12. *Sargentii*, Dode (*P. deltoides* var. *occidentalis*, Rydb. *P. occidentalis*, Brit. *P. monilifera* var. *occidentalis*, Henry). GREAT PLAINS COTTONWOOD. Lvs. usually smaller and with relatively longer abrupt acumination, broader at base and with fewer rather coarser teeth: young branches light yellow, shining: buds often pubescent: pedicels shorter than the caps. The Great Plains or xerophytic form, Neb. to Dak., Sask., Alberta and to New Mex.; frequent along stream-beds. S.T.S. 2:583.—Doubtfully specifically separable from *P. deltoides*.

(a) *P. Andrewsi*, Sarg. (*P. acuminata* × *P. Sargentii*). Raised by E. H. Andrews, Colo., from a cutting taken from a wild tree: lvs. oblong-ovate, gradually or abruptly long-pointed and acuminate, rounded or occasionally abruptly cuneate at the broad base, finely serrate except at apex, thin, bright green and shining above and



3134.
Eastern cotton-
wood.—*Populus*
deltoides var. *monilifera*. (× $\frac{1}{2}$)



3135.
Winter buds
of *Populus*
deltoides var.
monilifera.
(× $\frac{1}{4}$)



3136. Young tree of *Populus deltoides* var. *monilifera*, showing the spreading open growth.

rather paler below; petiole nearly terete; branchlets light orange-brown; winter-buds acuminate, resinous.

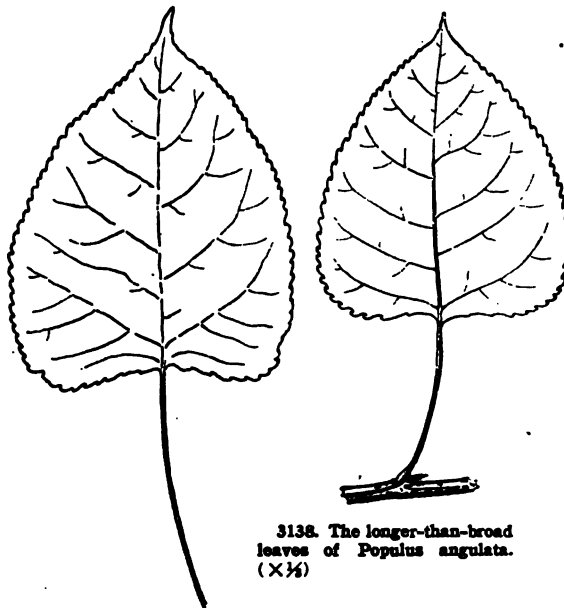
13. *angulata*, Ait. HYBRID CAROLINA POPLAR. Fig. 3138. For more than a century considered to be a native tree in the S., although by most botanists not clearly separated from *P. deltoides*, but Aiton's original specimens are interpreted by Henry to represent a hybrid of *P. deltoides* and *P. nigra* var. *typica*; similar forms are known in Europe and are planted in this country: known in both sexes: strong-growing tree with mostly prominently ridged or angled branchlets: lvs. triangular-ovate, always longer than broad, at the base truncate or more or less cordate, at the apex acute or short-acuminate, at maturity glabrous and firm in texture but slightly pubescent when young, glands 2-6 at base of blade or on apex of petiole, the margin except at apex with narrow translucent border, crenate-glandular and ciliate with the teeth close together; petiole flattened; catkins 2-3 in. long, with small cucullate or concave-dentate (not filiform-lobed) scales; stamens 30-40. Henry suggested that the floral characters (as seen in Aiton's type) may be a mutation under European conditions, inasmuch as catkins with the scales of the species described by Aiton appear not to have been identified from the wild in N. Amer., but later he has proposed the hypothesis of the hybrid origin and this seems to go far toward clearing up the difficulties of this perplexing group. The tree is still recognized as cult. in England and France, where it was known as early as 1750. In general, the longer-than-broad lvs. which are merely acute or short-acuminate rather than long-acuminate, and with deeply cordate or truncate base, distinguish this form. It is a loose open grower, with nothing of the strict narrow shape of the common Carolina poplar of the streets, which is probably *P. Eugenei*. It is hardy in N. Y. How extensively *P. angulata* occurs as a planted tree in N. Amer. should be made a subject of inquiry.

14. *Eugenei*, Simon-Louis. EUGENE POPLAR. Figs. 3139-3141, but known apparently to horticulturists as Carolina poplar: strict-growing strong staminate tree mostly with a markedly excurrent trunk (st. or bole continuing through the top or head) and with many strongly ascending branches, making the top narrow and almost columnar or pyramidal and densely foliated, but with more or less hanging small spray on the under side or bottom of the head, the tree shedding its branchlets or little twigs freely: lvs. mostly triangular-ovate (broadest below the middle) and long-acuminate-pointed, truncate or slightly cuneate-truncate at base, crenate-serrate with close mostly incurved teeth, petioles flattened: autumn buds long, only slightly viscid, those in the upper axils slender and often curved-pointed.—This interesting and valuable rapid-



3137. Eastern cottonwood, *Populus deltoides* var. *monilifera*.—The Lafayette tree at Geneva, N. Y., named for General Lafayette, and one of the largest trees in the state.

growing poplar was found in 1832 as a chance seedling in the Simon-Louis nursery, near Metz, France; it is supposed to be a hybrid between Lombardy poplar (male) and *P. regenerata* (female) and it has the marks of the two. It is now one of the horticultural poplars and is often confounded with the native cottonwood. Henry writes that the original tree is, in his opinion, "the



3138. The longer-than-broad leaves of *Populus angulata*. ($\times \frac{1}{4}$)

most wonderful tree in Europe in point of vigor, as it measured in 1913, when 81 years old, no less than 150 ft. in height and 25 ft. in girth at 5 ft. above the ground, and appears to be still growing rapidly. Another tree, a cutting of the last, planted in 1870, was 140 ft. high by 15 ft. in girth." Some of the tall Carolina poplars planted in the eastern parts appear to be *P. Eugenei*, or a very similar hybrid.

In this account, the poplars of this group in E. N. Amer. (east of the Mississippi) are assumed to be of a single species, *P. deltoides*, and what has been thought to be *P. angulata* of the southern states is taken as the type of the species, and the true *P. angulata* is considered to be a hybrid that is more or less planted. Whether other species are involved is to be determined by much further study of the unquestioned native forms. It is not unlikely that there are unrecognized natural hybrids. Tidestrom considers that there are 3 species in Maryland, *P. virginiana*, *P. deltoides*, and *P. angulata* (Rhodora, xvi. 208, 1914). The lf.-forms in cult. are very confusing if one desires to find separable types without numberless intermediates. Taken in a broader sense, *P. deltoides* may be considered to range through the country east of the Rocky Mts. being represented in the S. by the type form, and in the W. by var. *occidentalis* (*P. Sargentii*). In a still wider sense, *P. Fremontii* and *P. Wislizenii* may be regarded as geographical forms.

Very recently, A. Henry has distinguished 3 forms of the eastern cottonwood, and has taken up the name *P. deltoides* although not certain as to the original application of it. The 3 forms are: (1) *P. deltoides* var. *monilifera*, Henry (*P. monilifera*, Ait.), the form of the northeastern country: lvs. deltoid-ovate, about 3 in. long and wide, abruptly contracted into a long non-serrated apex, the base wide and shallowly cordate, bearing 2 glands at the junction with the petiole in front, the margin densely ciliate, both surfaces and petiole glabrous except for a few evanescent hairs on midrib and main nerves. G.C. III. 56:4 (tree in winter). (2) *P. deltoides* var. *occidentalis*, Rydb. (See *P. Sargentii*, No. 12). (3) *P. deltoides* var. *missouriensis*, Henry (*P. angulata* var. *missouriensis*, Henry). Lvs. similar in shape to those of var. *monilifera* but larger, being 5 or 6 in. wide and long, both surfaces and the petiole pubescent with some of the pubescence remaining in summer, the basal glands 3 or 4. La. to Mo., also in Ga.

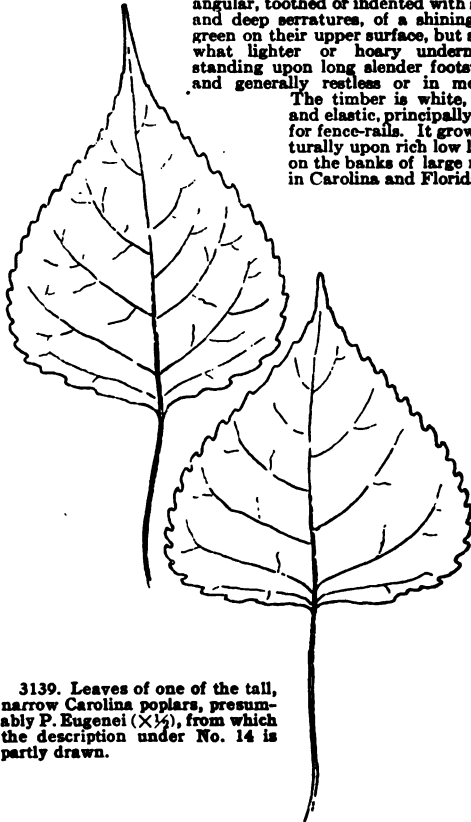
The botanical names of these native poplars are confused. If it is assumed that there is only one species in this group, then we may apply to it the name *P. deltoides*, modified from Marshall, 1785, or *P. canadensis*, Moench, 1785; but the descriptions under these names are not sufficient to designate the species if we undertake to define them closely. *P. virginiana*, Foug., and *P. carolinensis*, Moench, are undeterminable from the descriptions. There is every probability that Marshall in his "Arbustum Americanum" (1785) meant to designate the Carolina poplar by his *P. deltoides*.

(which has recently been taken up by botanists under the forms *deltoides* and *deltoides*). Koch, in his *Dendrologie*, however, suggests *P. grandidentata* as the species meant by Marshall, but the range of this species forbids. The full account in Marshall is as follows:

"*Populus deltoide*. *White Poplar*,
or *Cotton Tree* of
Carolina

"(Bartram's Catalogue).

"This becomes a tall tree, with a large erect trunk, covered with a white, smoothish bark, resembling that of the Aspen tree. The leaves are large, generally nearly triangular, toothed or indented with sharp and deep serratures, of a shining full green on their upper surface, but somewhat lighter or hoary underneath; standing upon long slender footstalks, and generally restless or in motion. The timber is white, firm, and elastic, principally used for fence-rails. It grows naturally upon rich low lands, on the banks of large rivers in Carolina and Florida."



3139. Leaves of one of the tall, narrow Carolina poplars, presumably *P. Eugenei* ($\times \frac{1}{2}$), from which the description under No. 14 is partly drawn.

The first undisputed binomials, reinforced by specimens, appear to be those of Aiton, 1789, *P. monilifera* and *P. angulata*. It is unfortunate that Marshall's *P. deltoide* has been revived in order to satisfy the demand for priority: it is not Latin; it may be rendered either in the form *deltoides* or *deltoides*, thereby introducing confusion: the only way of determining what plant he had in mind is by habitat and range—"rich lowlands" "in Carolina and Florida." As we now define the poplars of Carolina and Florida there is only one species, but it is not unlikely that others will be separated. Marshall's name, as the other very early names, should be disregarded and Aiton's *P. monilifera* taken as the starting-point. The name *P. canadensis* has been variously applied by succeeding authors: it is probably a female hybrid; at least some of the stock once grown in N. Amer. under this name was *P. deltoides*: the name should be discarded. *P. virginiana*, Foug., 1786, is fairly well defined by Castiglioni (*Viaggio Negli Stati Uniti* . . . pub. at Milano, 1790), and appears to be the species named *P. monilifera* by Aiton, 1789, but to take up the name would contribute nothing to clarity.

The Carolina poplar was early planted in this country. It was apparently known to John Bartram. It is mentioned by M' Mahon in his "Gardener's Calendar," 1806. It is listed in the catalogue of William Booth, of Baltimore, 1810; also by William Prince of Flushing, Long Island, in 1823, 1825, 1829, by Landreth, of Philadelphia, in 1828. What form of poplar all these early planters had is not now to be determined. To what extent the hybrid Carolina poplar (*P. angulata*) is now planted in this country is unknown to the writer. It is apparent that European hybrid poplars are useful here and they have been intro. from time to time. The prevailing "Carolina poplar" of present planting in the northeastern states is probably *P. Eugenei*, but others may be involved. The binomials that have been applied more or less loosely or erroneously to the *P. angulata* group on the supposition that it is a species of the S. U. S. are as follows: *P. angulosa*, *P. macrophylla*, *P. deltoides* var. *angulata*, *P. carolina*, *P. caroliniana*, and *P. carolinensis*, Hort.; *P. deltoides* var. *carolinensis*, Bailey; *P. deltoides* var. *missouriensis*,

Henry. If *P. deltoides* is itself taken to be this southern form, then all these synonyms must now be ranged under that name, so far as they may apply to the plant in question.

Supposed or accepted hybrids in the black poplar group (*P. nigra-deltoides-angulata*) are recognised as follows (only two or three of which are likely to be found in this country unless in special collections):

(a) *P. serotina*, Hartig (*P. helvetica*, Poed. *P. angulata* var. *serotina*, Koehne). BLACK ITALIAN POPLAR. SWISS POPLAR in France. A valuable timber tree: very strong staminate tree with a broad head and wide-spreading but ascending branches and regularly furrowed bark: buds brownish and viscid: lvs. appearing very late (hence the name *P. serotina*), reddish tinged and glabrous, larger than those of *P. Eugenei*, ovate-deltoid with broad truncate base and short cuspidate or acuminate apex, with few crenate serrations rather far apart and toward the base of the blade, the glands 1, 2 or 0, near the apex of the reddish petiole: young plants and vigorous growths with ridged shoots, and lvs. 5-6 in. or more long. G.C. III. 56:47.—A very old hybrid, having been described by Duhamel in 1755. *P. deltoides* var. *monilifera* is probably one of the parents, and *P. nigra* var. *typica* the other. Very likely one of the planted poplars in this country and apparently sometimes passing as *P. deltoides*.

(b) *P. marilandica*, Boer (*P. carylon*, Dode). Pistillate tree that originated early in the 19th century: buds small and viscid: lvs. (resembling those of *P. nigra*) 4 x 3 in., rhomboid, cuneate at base, tapering above into a long-acuminate apex, glabrous, crenate-serrate with incurved teeth, the margins with minute scattered hairs. Appears to be a hybrid of *P. deltoides* var. *monilifera* and *P. nigra*.

(c) *P. Henryana*, Dode. Of unknown origin: of branching open habit similar to that of *P. deltoides* var. *monilifera*: a staminate tree, with lvs. cuneate at broad base: "of no particular vigor," and little known. G. III. 56:46.

(d) *P. robusta*, Schneid. Probably the issue of *P. angulata* x *P. plantierensis*: of narrow columnar habit but short branches much more divaricate than in the Lombardy, of very rapid growth: twigs hairy: staminate. G.C. III. 56:66.

(e) *P. regenerata*, Schneid. (*P. Eucalyptus*, Hort.). Pistillate tree like *P. serotina* in twigs and foliage but lvs. opening 2 weeks or more earlier, of narrow outline and bearing pistillate fls.: catkins similar to those of *P. marilandica*, but with usually only 2 stigmas.

(f) *P. Libydl*, Henry (probably *P. nigra* var. *betulifolia* and *P. serotina*). Tall pistillate tree with pubescent branchlets, described by Henry as follows: Bark similar to that of *P. serotina*: young branchlets with minute pubescence, glabrous and yellowish brown the second year: buds small, viscid: lvs. about 2½ in. wide and long, truncate, rounded or cuneate at base, with a short non-serrated, acuminate or cuspidate apex, crenate-serrate, teeth incurved-ciliate till late summer; glands minute, often absent; petiole reddish with minute pubescence: pistillate catkins 2-2½ in., glabrous; pedicels short, ovary globose, in a cup-shaped oblique entire disk with 2, rarely 3, dilated spreading stigmas: fruiting catkins 4 in.; caps. 2-valved. G.C. III. 56:67.

(g) *P. generosa*, Henry. Intermediate between the parents (*P. angulata*, pistillate, and *P. trichocarpa*) in width and color of lvs., the under surface pale gray; resembles *P. angulata* in having coarsely serrate often cordate translucent-bordered lvs., but *P. trichocarpa* in bearing rounded petioles. A plant of "astounding vigor," issued from a cross made at Kew in March, 1912. G.C. III. 56:258, 259. See also Henry, Trans. Roy. Scott. Arbor. Soc. 30, p. 25, fig. 10; and Journ. Dept. Agric. Ireland, 15:44.—A tree of much promise. It originated from hand-pollination, *P. trichocarpa* furnishing the pollen, four seedlings resulting.



3140. Winter buds of *Populus* No. 14. ($\times \frac{1}{2}$)



3141. The tree commonly known as Carolina poplar. Probably *Populus Eugenei*.

IV. **HEAVY OR LARGE-LEAVED POPLARS OF COTTONWOODS.** *Lvs. large and broad, rounded or cordate rather than truncate at base, not lobed, the petiole cylindrical or channelled, not flat, more or less pubescent but becoming mostly glabrous at least above: terminal buds medium to large size, more or less glutinous but scarcely balsamic: trees, mostly of good size.*

15. *lasiocarpa*, Oliver (*P. Fargesii*, Franch.). Tree, 50-60 ft., with angular stout more or less pubescent young shoots and large viscid buds: *lvs.* very large (often 10-14 in. long and 8-9 in. wide), ovate or broad-oblong, acute or short-acuminate, evenly glandular-crenate-serrate, red-veined, deeply cordate at base and biglandular, more or less tomentose beneath but becoming glabrous above; petiole nearly cylindrical, red; stipules oblong-lanceolate; catkins 4-6 in. long or longer in fruit, the polygamous fls. short-pedicelled; bracts ovate or obovate, finely lacinate; stamens 23 or more in the male fls. and 3-6 in the hermaphrodite fls.: caps. ovoid and densely woolly, to $\frac{1}{2}$ in. long. China, common at 4,000-6,000 ft. B.M. 8625. R.H. 1911, p. 565. R.B. 35, p. 312. G.M. 51:763.—*P. Wilsonii*, Schneid., is a rare tree in W. China, with a pyramidal or columnar head of short spreading branches and strikingly handsome dark bluish green paper-like broad-ovate or roundish or broadly ovate-oblong more or less cordate-based and obtuse *lvs.* which are less deeply cordate than those of *P. lasiocarpa*, and less broadly oblong; it is also distinguished by its habit, the glabrous and purple rather than tomentose and yellowish branchlets, and the *lvs.* bluish green above and rather whitish gray beneath.

16. *heterophylla*, Linn. **SWAMP OR BLACK COTTONWOOD. DOWNY POPLAR.** A swamp species of irregular branching habit, only rarely planted, reaching 80 ft. and diam. of trunk of 3 ft.: *lvs.* densely tomentose when young, but becoming glabrous with age or remaining floccose beneath, 4-7 in. long, broad-ovate in outline, obtuse or somewhat acute at apex, more or less



truncate or subcordate or rounded at base, serrate, the petiole terete and tomentose or nearly glabrous: staminate catkins stout but rather short, stamens 12-20 and scales filiform-lobed; pistillate catkins slender but rather short, becoming erect or spreading: caps. ovoid-acute, on slender pedicels. Conn. to Ga., La., Ark. and S. Mo.; near the coast in the northern states. S.S. 9:489.

V. **BALSAM POPLARS. TACAMAHAC.** *Lvs. not lobed, varying from broad-ovate to narrower; mature lvs. whitish but not cottony-tomentose beneath, not clearly translucent-edged; petioles cylindrical or 4-angled, mostly grooved on upper side: terminal buds large to very large, very viscid and balsamic in odor: mostly large trees.*

A. *Branchlets terete, without projecting ridges or ribs (except sometimes on strong young shoots).*

B. *Petioles and branchlets mostly glabrous.*

17. *balsamifera*, Linn. **BALSAM POPLAR. TACAMAHAC.** Figs. 3142, 3143. Tall upright tree, with a narrow top and glabrous twigs: *lvs.* thick and firm, erect, whitened beneath, usually smaller than in most poplars of this group, glabrous except that petioles are slightly pubescent, ovate-lanceolate or oval, tapering toward the top and obtuse or narrowly rounded at base, finely and obtusely toothed: catkins drooping, slender but rather densely fld., appearing in very early spring; ovary 2-carpeled: caps. pedicelled. Mackenzie River to Newfoundland and to Brit. Col., southward in the northern tier of states; not in Asia. S.S. 9:490. Var. *Michauxii*, Henry (*P. Michauxii*, Dode. *P. canadensis*, Amer. Auth. in part, not Ait.), is a form with slightly cordate or rounded-based ovate *lvs.* and slightly pubescent on petioles, veins beneath and twigs. G.C. III. 59:230.—The native *P. balsamifera* is sometimes seen about farm buildings and roadsides, where it makes a durable and interesting tree. The dull whiteness of the under side of the leaves affords a pleasant variety and contrast in its foliage, and the fragrance of the resinous buds in spring is agreeable to most persons. It is a desirable tree for occasional planting, but, like the Lombardy, it generally appears to best advantage when placed amongst other trees. It is a hardier tree than the Lombardy, and does not run quickly to such extravagant heights. In cult., it seems to present a variety of forms or else enters into a number of hybrids. The true *P. balsamifera* is said to be rare in cult. in Cent. Eu., and only in the male sex.

In Mont. and Idaho is a balsam poplar with sessile 3-carpeled caps., as in *P. trichocarpa*, although differing in other fr. characters from that species: *lvs.* usually broader than in *P. balsamifera* and often subcordate, glabrous. This form Rydberg considers to be *P. hastata*, Dode.

In the Himalayan region, *P. ciliata*, Wall., belongs to this group, but it is probably not in cult. in this country: *lvs.* ovate or ovate-cordate, acuminate, glabrous except for the gland-ciliate unequal teeth, the base 3-nerved: a large tree, with *lvs.* 3-7 in. long.

18. *fortissima*, Nels. & Macbr. (*P. angustifolia*, James, not Weinm. *P. balsamifera* var. *angustifolia*, Wats.). Fig. 3144. **NARROW-LEAVED COTTONWOOD.** Small pyramidal or conical tree (reaching 60 ft. in the wild), with slender twigs and small buds, and soft clear green foliage: bark rough-furrowed: *lvs.* small for the genus, lanceolate or ovate-lanceolate, short-stalked, green on both surfaces, finely and evenly serrate: catkins short, densely fld.: ovary somewhat 2-lobed. Interior region from Assiniboia to Neb. and Ariz., and westward; common along mountain streams at middle altitudes in the Rocky Mts. S.S. 9:492.—Common street tree in parts of the W. and sometimes planted in the E. for ornament.



3143.
Winter buds
of *Populus*
balsamifera.
($\times \frac{1}{2}$)

19. *acuminata*, Rydb. (*P. coloradensis*, Dode). SMOOTH-BARKED COTTONWOOD. Tree slender, with

smoother and lighter-colored bark than in *P. fortissima*: lvs. long-petioled, rhomboid-lanceolate, acuminate, serrate only at the middle: pistillate catkins slender. Eastern slopes of Rocky Mts.—A well-shaped and attractive tree in cult., the lvs. long-acuminate and somewhat

drooping. *P. Tweedyi*, Brit., is allied to this species and perhaps a variant of it, with mature lvs. broadly ovate or some of them even orbicular, and cordate at base. Wyo.

BB. Petioles and branchlets mostly pubescent (becoming glabrate at full maturity).

20. *candicans*, Ait. (*P. Tacamahaca*, Mill. *P. ontariensis*, Desf. *P. balsamifera* var. *candicans*, Gray. *P. macrophylla*, Hort.). BALM OF GILEAD. ONTARIO POPLAR. Strong-growing

spreading pistillate tree, much planted in Eu. as "the balsam poplar" and esteemed for its vigor and hardiness and the resinous fragrance of its large buds in springtime: lvs. broad and

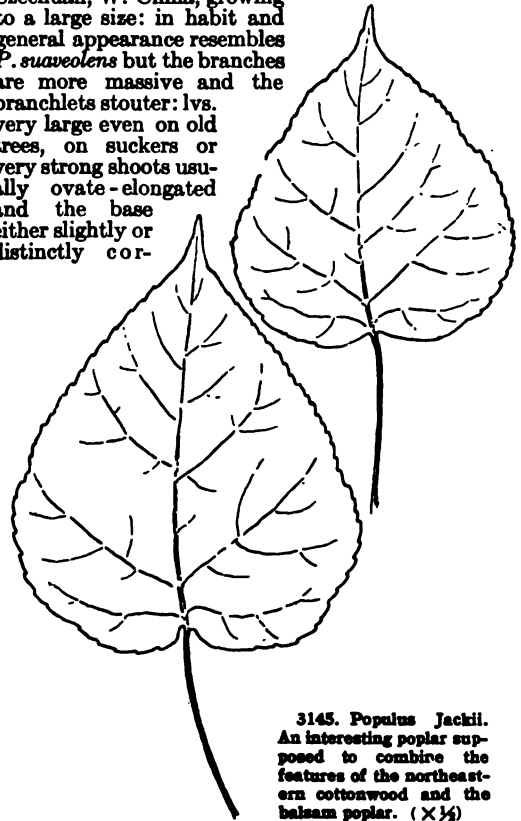
heart-shaped, very hairy (as are also the twigs), the lf-stalk usually hairy and somewhat flattened. G.C. III. 59:230. Apparently a hybrid, the origin of which is in doubt; the native tree usually confused with this is *P. balsamifera* var. *Michauxii*, and sometimes also the supposed hybrid, *P. Jackii*.—Said to be sometimes grown under the names of *P. suaveolens* and *P. balsamifera*. It is very different from the balsam poplar in method of growth, as it has none of the pyramidal or spire-like tendency of that species, but usually makes a broad and irregularly spreading top. The Balm of Gilead makes a good street tree, and is perhaps the best of the older poplars for shade, but it is not known how extensively it is planted in N. Amer.; it is probably of European origin. Well-grown trees of the form passing under this name in the U. S. have the darkest and richest foliage of any common poplar, and this character makes the tree valuable in heavy groups about the borders of a place. The top is liable to become open and broken with age, however, and the tree often sprouts profusely. It is not well adapted to smoky and dusty locations, as it soon becomes grimy.

21. *Jackii*, Sarg. (*P. Baileyana*, Henry). Fig. 3145. A supposed hybrid of *P. deltoides* var. *monilifera* and *P. balsamifera*, found as if native in Mich. and Que.: intermediate between the two parents, with terete glabrous twigs: lvs. large, broad-ovate, cordate at base, biglandular, slender-acuminate, the margin with scattered deciduous hairs and a translucent border, the under surface pale but scarcely whitish, the petioles channeled but not compressed, 4-angled in cross-section. G.C. III. 59:231.—The buds are less viscid than those of *P. balsamifera*, and the leaf-serratures are not so sharp. It makes a broad-headed branching tree. The range of this tree is not known.

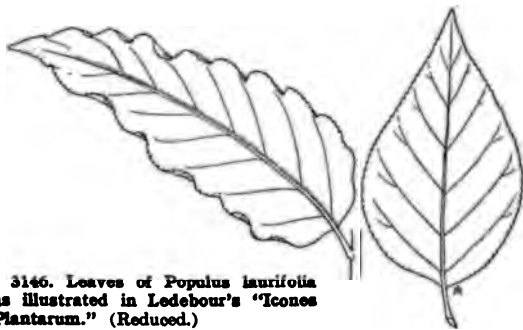
22. *tristis*, Fisch. Small tree with viscid pubescent buds which are often attended by persistent ovate-acuminate stipules: lvs. narrowly ovate, 4 in. long and one-half as broad, ciliate, acuminate, subcordate or rounded at base. Cent. Asia, Himalaya.

23. *Maximowiczii*, Henry. JAPAN POPLAR. Very large tree, to 100 ft., and 3-4 ft. diam., with densely pubescent pale brown branchlets: lvs. about 4 in. long, nearly orbicular, oval or broad-elliptic, broadest above the middle, subcordate, cuspidate, pubescent on ribs and nerves of both surfaces, whitish or slightly rusty beneath, finely and sharply serrate and ciliate: fruiting catkins 7-10 in. long, remaining unopened on the tree till late summer or autumn, the caps. glabrous. E. Siberia, N. Japan.—Hardy and desirable, making a shapely head and bearing attractive foliage. It is sometimes confused with *P. suaveolens*. Wilson speaks of this tree as a magnificent poplar, the largest in eastern Asia, the trunk reaching 5 or 6 meters in girth.

24. *suaveolens*, Fisch. (*P. balsamifera* vars. *suaveolens* and *intermedia*, Loud.). A comparatively slow-growing tree of close, upright habit: young branches slightly pubescent above nodes: lvs. very thick and hard, finely serrate, oval to ovate and ovate-lanceolate in outline, and prominently whitened beneath, commonly rather small for this group, the margin ciliate, and finely crenate-serrate: twigs hard and cylindrical. Siberia, Mongolia, China.—It is considered to be a valuable tree for hot and dry interior climates; and it also has distinct merit for ornamental planting. It eventually becomes a large tree. The *Populus laurifolia* and *P. sibirica pyramidalis* of some American nurserymen are apparently variations of this type. *P. Przewalskii*, Maxim., is probably a form of this with glabrous branchlets and petioles. *P. szechuanica*, Schneid., a common tree in forests of Province Szechuan, W. China, growing to a large size: in habit and general appearance resembles *P. suaveolens* but the branches are more massive and the branchlets stouter: lvs. very large even on old trees, on suckers or very strong shoots usually ovate-elongated and the base either slightly or distinctly cor-



date or rounded and sharply glandular-crenate-dentate, on the old branches broad-ovate or ovate-orbicular with rounded or more or less cordate base and the margin more or less distinctly glandular-dentate. Growing at the Arnold Arboretum and the Rochester parks. *P. yunnanensis*, Dode, is allied to *P. szechuanica* but is insufficiently understood.



3146. Leaves of *Populus laurifolia* as illustrated in Ledebour's "Icones Plantarum." (Reduced.)

AA. Branchlets prevailing with projecting narrow ridges.

25. *laurifolia*, Ledeb. (*P. balsamifera* var. *laurifolia*, Wesm.). Fig. 3146. Tall tree with gray-brown bark and smooth angled twigs: lvs. ovate to ovate-oblong to ovate-lanceolate or even narrower, acuminate, sometimes undulate, rounded at base, finely toothed and somewhat ciliate, green above, more or less pubescent on midrib at maturity, whitish beneath: stamens 20-30; pistils sessile, 2-valved; staminate catkins about 3 in. long, pistillate 4-5 in. Siberia.

26. *Lindleyana*, Carr. (*P. laurifolia* var. *viminilis*, Dipp.). Fig. 3144. Lvs. mostly willow-like, long-elliptic, distinctly acuminate, or oval-elliptic on the older shoots, roundish at base, with pubescent petioles, fls. and fr. Perhaps a horticultural group, to which are probably to be referred the garden names *P. crispa* (with more or less crisped or crinkled margins), *P. Dudleyi* and *P. salicifolia*. As seen in cult. in this country (and very infrequent) it is a small or medium-sized tree, of slender growth and with a somewhat weeping habit when old. It is very like the native *Populus fortissima*, but is readily distinguished by its angled or furrowed sts., and less tapering and crisped lvs. which are conspicuously finely reticulated and whitened beneath. The color of its foliage is grayish green, and in this respect it affords a contrast to the native species. *P. fortissima* seems to be rather the better tree of the two, although *P. Lindleyana* has a more striking appearance. The botanical status of these trees is not clearly defined. By some, *P. Lindleyana* is referred to *P. laurifolia*, but the tree in cult. seems to be distinct.

27. *Simōnii*, Carr. (*P. laurifolia* var. *Simōnii*, Regel. *P. balsamifera* var. *Simōnii*, Wesm. *P. brevifolia*, Carr.). A strong strict tree, not large, with lvs. differing from those of *P. candicans* in having a rounded or tapering base and much finer teeth, but otherwise they are somewhat alike: shoots reddish brown and spotted, deeply grooved, somewhat drooping; lvs. small, mostly oval and tapering both ways, hanging on slender petioles. Amoor Valley to China, where it is common. G.W. 15, p. 246.—Intro. into France about 1861 by M. E. Simon, and somewhat planted in this country. It has been planted as far north as Man. with entire success. It is a very rapid grower, and is useful where quick-growing windbreaks are desired. There are fastigate and weeping forms. Shape of lvs. variable, those on vigorous shoots being round-obovate, acute-based, and mostly rounded at apex.

28. *trichocarpa*, Torr. & Gray. BLACK COTTONWOOD. Very large tree, to 200 ft. and trunk to 8 ft. diam., with wide head or top and upright branches: lvs.

varying from narrow- to broad-ovate, truncate or cordate at base, acute or taper-pointed at apex, finely serrate, to 8-10 in. long, shining green above and rusty but becoming whitish beneath: catkins 2-5 in. long; stamens 40-60; pistillate catkins loose-flid., in fr. becoming as much as 10 in. long; ovary 3-carpelled: caps. nearly sessile. Calif. to Brit. Col. and Alaska, reaching an elevation of 6,000 ft. S.S. 9:493. G.F. 5:281.—Aside from the conifers, it is said to be the largest tree in Ore. to Brit. Col. For *P. hastata*, see No. 17.

Following are supposed hybrids in the balsam poplar group:

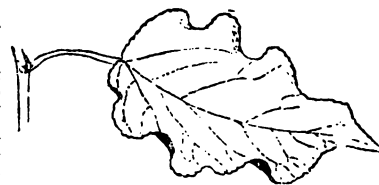
(a) *P. berolinensis*, Dipp. (*P. certinensis*, Dieck. *P. pseudo-balsamifera*, Fisch.). Columnar tree supposed to be of hybrid origin, with short ascending branches, the growths densely pubescent and the young ones slightly winged but often becoming nearly or quite smooth at maturity: buds greenish, pointed, viscid: lvs. on strong shoots 3-4 in. long, ovate or ovate-rhombic, mostly rounded but sometimes cuneate at base, contracted into a long glandular acuminate point, glabrous on both surfaces, greenish or slightly whitish beneath, the margin not ciliate and with a very narrow translucent edge visible under a strong lens, the margins usually regularly crenate-serrate and sometimes with irregular shallow lobes. Perhaps a hybrid between Lombardy poplar and *P. laurifolia*. The name *P. certinensis* was applied to the staminate plant.

Whether the *P. certinensis* grown in N. Amer. (Fig. 3147) all belongs with *P. berolinensis* is very doubtful. Some of it seems to have many of the characters of *P. deltoides*. As grown in nurseries and collections here, it is a very rapid-growing and hardy tree, with a strong central leader and very heavy dense foliage; differs from *P. monifera* as follows: lvs. broad-ovate in outline, with a rounded or tapering base and rather short point at the apex; the margin rather closely-toothed, wavy; fl.-stalk comparatively short, only moderately flattened, glandless at the top; stipules present and conspicuous: bud long; shoots slightly hairy.—The foliage on the old wood or upon slow-growing shoots is very unlike that upon the vigorous branches and is almost identical with that of the balsam poplar, being broadly oval, with finely serrate margins, and whitish beneath. The twigs, also, are cylindrical. But the strong shoots are strongly angled or grooved and the foliage is much like that of the native cottonwood, but darker; and the growth is more close and erect. The sketch in Fig. 3147 distinguishes the lvs. The *Certinensis* poplar is a more rugged tree than the cottonwood, with healthier foliage in the presence of H.-rust, and its wood is said to be valuable. It has been much planted in the N. W., and deserves to be widely distributed. Its effect in the landscape is considerably unlike that of the cottonwood. Its lvs. stand out more horizontally, while those of the cottonwood hang loosely and often vertically and therefore give the tree-top a heavier look. The terminal spray of the two is particularly distinguishable in this regard. The lvs. of *Certinensis* upon the strong, erect shoots stand almost at right angles to the shoot, and, at some distance, therefore, present only their ruffled edges to the eye, producing a unique and picturesque effect. The illustration (Fig. 3147) represents a top leaf of *P. certinensis* as grown in this country, but the name may not be correctly placed.

(b) *P. Wöbstii*, Schroed. (*P. Wöbsky*, Hort.?). Buds very viscid: lvs. 4-6 in. long and 2 in. broad, lanceolate, with widest part about the middle, narrow but rounded at base, gradually tapering toward the bluntly acuminate apex, slightly pubescent, white beneath, ciliate and crenate-serrate; petiole with few scattered hairs: branchlets glabrous.

(c) *P. Rasumowskyana*, Schroed. Buds pointed, viscid: lvs. on young trees and vigorous shoots 4 x 3 in., orbicular-ovate, rounded or subcordate at base, contracted above into a gland-tipped acuminate apex, very nearly glabrous, pale beneath, the margin glandular-crenate and not ciliate; petiole terete, grooved above; branchlets glabrous, ridged. *P. Nolestii*, as it has been grown in this country, is either this form or very like it, but is little understood.

(d) *P. Petrowskyana*, Schroed. Very like *P. Rasumowskyana*, but with minute pubescence on branchlets and petioles; lvs. on vigorous shoots 5 x 4 in., ovate, cordate, the apex long-acuminate, pale beneath; serrations deeper than in last.



3147. *Populus certinensis* of American plantations. (X/4)

VI. VARIABLE-LEAVED POPLARS. Lvs. remarkably polymorphous or diverse on the same plant, from very narrow to broad, coriaceous and reticulate, the petiole more or less cylindrical, the buds little if at all viscid: stamens few (about a dozen): caps. pedicellate, elongated; stigmas 3.

29. *euphratica*, Oliver (*P. diversifolia*, Schrenk. *P. aridana* and *P. Litwinowiana*, Dode). Medium-sized tree,

to 50 ft., attaining 2 ft. or more in diam., with pubescent not viscid buds and terete branches: lvs. on young shoots broad-linear (3-6 in. long) or oblong, short-stalked, entire; on short shoots or older parts half as long, ovate to rhombic to orbicular and more or less lobed or cut, at base rounded, cordate or cuneate, the stalk 1-2 in. long: catkins loose; stamens 8-12, scales cut, and disk orbicular; pistillate disk tubular and cleft: caps. to $\frac{1}{2}$ in. long. Egypt and Syria to Cent. Asia and China. Gt. 7, p. 170.—It is the "willow" of the Children of Israel; perhaps planted within our range. *P. pruinosa*, Schrenk, is a related tree of Turkestan and S. W. Siberia, with bark on the old trunks distinctly and deeply grooved as in ash and elm, whereas *P. euphratica* has a shaggy bark: lvs. ovate-elliptic to reniform, never lanceolate, entire. *P. Denhardtiorum*, Dode, a tree 60-80 ft. high in E. Trop. Afr., from sea-level to 1,500 ft. altitude, differs from *P. euphratica* in female racemes being shorter, perianth more deeply divided, ovary larger, and with a very large plane stigma: petioles twisted, so that the lvs. hang vertically. Tree used by the natives for dug-out canoes.

L. H. B.

PORANA (native name). *Convolvulaceæ*. Large twining annual herbs or shrubs, sometimes grown for ornament.

Leaves petioled, ovate, entire: infl. cymose or racemose; fls. purple, steel-blue or white; sepals in fl. small, narrow, in fr. all or 3 much enlarged; corolla campanulate or funnel-shaped, wide- or narrow-mouthed; limb 5-plaited, nearly entire or lobed; ovary 2-celled, 4-ovuled: fr. a globose membranous oblong or obconic caps. indehiscent or 2-valved.—About 15 species from Trop. E. Afr., oriental tropics and N. Austral.; 1 species reported from Mex. The two following species have been intro. into S. Calif., but are said to be hardly worth growing. *P. paniculata*, Roxbg. Strong shrubby climber often 30 ft. high: lvs. 5x3 in., pubescent above: panicles terminating every branchlet with innumerable fls.; sepals in fl. linear-oblong; corolla glabrous, campanulate, white, very short-lobed: caps. globose, hairy. India, Malaya. Gn. 61, p. 323. *P. racemosa*, Jacq. f. An annual, forming dense, not lofty masses: lvs. 2-3 x $1\frac{1}{2}$ in.: racemes lax; bracts at the forks leafy, sessile, scarious in fruit: sepals in fl. linear-oblong, puberulous; corolla lobed nearly half-way: caps. apiculate, glabrous. India. Called the "snow-creper" by the English as the masses of white fls. resemble snow in the jungle.

F. TRACY HUBBARD.

PORANTHERA (Greek, referring to the anthers opening by 4 pores). *Euphorbiaceæ*. Plants rarely grown in greenhouses as ornamental subshrubs. Heathlike, herbaceous to somewhat woody: lvs. alternate or rarely opposite, small, narrow, margin recurved: fls. small, in dense, short-peduncled racemes or heads, monœcious; calyx imbricate, petals present, at least in the staminate fls.; anthers 4-celled, opening by 4 pores; ovules 2 in each cell. Five species in Austral. There are no well-known related genera. *P. ericifolia*, Rudge. Six to 12 in. high: lvs. linear, crowded, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: fls. white, in a dense terminal corymb. E. Austral. In cult. in Eu. Peat soil is suitable for its cult. It is prop. from seeds.

J. B. S. NORTON.

PORTENSCHLAGIA (named for F. von Portenschlag-Ledermayer, an Austrian botanist, 1772-1822). *Umbelliferae*. Perennial herb, tall, much branched: lvs. ternately pinnatifid with filiform ultimate segms.: infl. a many-rayed composite umbel; fls. polygamous:

fr. ovate-cylindrical, in cross-section almost circular. One species from Dalmatia. There is also another *Portenschlagia* which belongs to the *Celastraceæ* and is included in *Elæodendron*. *P. ramosissima*, Vis. Tall and much branched: ultimate segms. of lvs. $\frac{1}{2}$ -1 in. long: fls. yellowish white; involucral bracts numerous, often membranous at the margins; petals hairy: fr. shortly hairy. Probably sparingly cult. abroad.

PORTLANDIA (named in honor of a duchess of Portland). *Rubiaceæ*. Glabrous shrubs and small trees, useful for the ornamental bloom.

Leaves opposite, thick-leathery, petiolate, oblong or linear-oblong; stipules between the petioles, connate with the petiole forming a sheath, deciduous: fls. large, 1-3-fld. on axillary peduncles; calyx 5-lobed, persistent;



3148. *Portlandia pterosperma*. ($\times \frac{1}{2}$)

corolla large, subcampanulate or funnelform, 5-lobed; stamens 5; ovary 2-celled: fr. an obovoid-oblong caps., turbinate or clavate, leathery.—About 10 species, Mex., W. Indies, but little known as horticultural subjects; probably useful far S.

platántha, Hook. Low shrub $1\frac{1}{2}$ -3 ft. high, glabrous: lvs. opposite, nearly sessile, elliptical-ovate, acute, evergreen, subcoriaceous; stipules broadly triangular, obtuse: calyx-lobes 4, spreading, leafy, lanceolate; corolla white, broadly funnelform approaching to campanulate, 5-lobed, the lobes spreading, ovate. Amer. B.M. 4534.—Requires moist tropical greenhouse heat and a mixture of loam and leaf-mold or peat-soil. Prop. by cuttings.

pterosperma, Wats. Fig. 3148. Shrub or small tree, 2-10 ft.: lvs. thin and deciduous: fls. numerous upon the young slender branches, 2 at nearly every node, pure white, funnelform, nearly 3 in. long; lobes of the corolla triangular, folded edge to edge in the bud so that it is strongly angled. Mex. G.F. 2:209 (adapted in Fig. 3148).—Probably hardy in the Gulf states and possibly in cult.

Other species which may appear in cult. are *P. coccinea*, Swartz, a Jamaican species with scarlet fls. and yellow anthers, and *P. grandiflora*, Linn., a native of the W. Indies with white fls., reddish inside at the throat and 5 in. long, growing 10-14 ft. high.

F. TRACY HUBBARD.

PORTULACA (Latin name, of uncertain history). *Portulacaceæ*. PURSLANE. Low fleshy often trailing annual or perennial herbs, one of which is a common flower-garden plant, and one of which is sometimes grown in its horticultural form as a pot-herb.



3149. Capsules of *Portulaca grandiflora*. ($\times \frac{1}{2}$)

Leaves mostly alternate, thick, sometimes terete, entire: fls. mostly terminal, usually with 5 distinct petals and with several to many stamens, both borne on the calyx or receptacle-rim: fr. a small conical circumscissile caps. (Fig. 3149), containing many small seeds.—About 40 species in the tropical and temperate regions, mostly American. The fls. of

portulaca open in direct sunshine, but close in shadow. Two annual species are in cult., both thriving in the hottest exposures.

grandiflora, Hook. ROSE MOSS. Fig. 3150. St. slender and terete, prostrate or ascending, not rising over 6–12 in., hairy in tufts at the joints: lvs. scattered or somewhat clustered, short and terete: fls. large (usually 1 in. or more across in the cult. forms), terminal and subtended by clustered lvs., in many bright colors, soon withering: seeds small, metallic-gray or gray-black. Brazil and S. B.M. 2885. R.H. 1877:90. Gn. 45, p. 436. G. 31:719.—Said to be perennial under glass. Runs into many garden forms, as: Var. *Thellusonii*, Hort. (*P. Thellusonii*, Lindl.), with handsome orange-scarlet fls. B.R. 26:31. R.H. 1852:5. Var. *splendens*, Hort. (*P. Gilliesii*, Hook.), light red-purple. B.M. 3064. Var. *albiflora*, Hort., clear white. Var. *sulphurea* or *Thorburnii*, Hort., dark yellow. Var. *caryophylloides*, Hort., red, striped white. Var. *Bédmannii*, Hort., clear white and purple-striped.—Colors



3150. *Portulaca grandiflora*. ($\times \frac{1}{2}$)

of the cult. portulacas range from pure white to yellow, rose, scarlet, deep red, and almost purple, with many striped forms. There are also many full double strains. The rose moss is most easy of cult. if it is given a hot and rather dry soil. It needs full sun. The seeds require a rather high temperature for germination, and therefore they are sown rather late,—near corn-planting time. Sometimes they are started indoors, but

usually they are sown directly where the plants are to stand. The soil need not be rich. The plant makes excellent edgings, and is good for growing in dry rock-work. A large patch of it gives a brilliant display of color in sunny weather, but the fls. do not open in dull weather. Seed of the double varieties produces more or less single-fl. plants, unless saved from cuttings of double-fl. plants, but the singles usually bloom earlier than the doubles. Let the plants stand 10–12 in. apart. They are tender to frost. The plant often self-sows, and in some places it persists about old gardens. *Portulaca grandiflora* was first described by Hooker in 1829 in the "Botanical Magazine." The fls. were described as "orange-colored, or of a very bright reddish purple."

The plant was "discovered by Dr. Gillies, growing in light sandy soil, in various situations between the Rio del Saladillo, or western boundary of the Pampas, and the foot of the mountains near Mendoza. On the western side of Rio Desaguadero plants were in great profusion, giving to the ground over which they were spread a rich purple hue, here and there marked with spots of an orange color, from the orange-colored variety which grew intermixed with the others."

oleracea, Linn. PURSLANE. PUSLEY. Fig. 3151. A common trailing weed in sandy ground, but also cult. in improved strains as a pot-herb: lvs. small, spatulate or narrow-obovate, very obtuse, thick, dull green or reddish: fls. small, yellow, the 7–12 stamens sensitive to a touch. Widely distributed in many countries; probably native to the southwestern parts of the U. S., but it is considered that it is intro. into the E. and N. In sandy and loamy soils it is one of the commonest and most persistent of weeds, but it is little known on heavy lands. The common wild plant is prized for "greens" in some regions, but the French upright forms are much better, as they are larger and more tender; these improved varieties look very different from the common "pusley;" they are easy of cult. For a discussion of the nativity of purslane in N. Amer., see Gray & Trumbull, Amer. Jour. Sci. 25, p. 253. L. H. B.



3151. Pusley.—*Portulaca oleracea*.

PORTULACARIA (similar to *Portulaca*). *Portulacaceæ*. Glabrous shrubs or small trees: lvs. opposite, obovate, fleshy: fls. small, rose, fascicled in the upper axils, forming a leafy panicle; sepals 2, short; petals 4–5, longer; stamens 4–7, inserted at the base of the petals; ovary free, 3-cornered, 1-ovuled: caps. 3-winged, indehiscent. Two species, S. Afr. *P. afra*, Jacq. Small tree, 10–12 ft. high: branches opposite: lvs. obovate-roundish, 4–6 lines long: peduncles compressed and branched: fls. small, pink. S. Afr.

POSOQUERIA (from a native name in Guiana). *Rubiaceæ*. Glabrous shrubs or small trees with terete branches, for the warmhouse, of which only one has appeared in the American trade, although some other species are rather commonly cultivated abroad.

Leaves opposite, coriaceous, entire; stipules between the petioles, rather large, deciduous: fls. in terminal corymbs, fragrant, white, rose, or scarlet; calyx 5-toothed; corolla long-tubed, limb 5-lobed; stamens 5;



XCI. Harvest scene in the potato country.



ovary 1-2-celled: berry ovoid, rather large, fleshy.—About 15 species in Trop. Amer.

longiflora, Aubl. (sometimes erroneously written *P. longifolia*). A handsome free-flowering bush 5-8 ft. high: lvs. oblong, acuminate, narrowed at the base, thick and shining: fls. 12 or more in a cluster, 3-5 in. long, waxy white, very fragrant, the slender tube curved, hairy in the throat. French Guiana.—Prop. by cuttings of ripening wood.

densiflora, Hutchins. Evergreen few-branched shrub: lvs. ovate-elliptic, apex subacute or short-acuminate, base rounded or sometimes slightly cuneate: fls. in a congested corymb, short-peduncled; calyx deeply 5-lobed; corolla white, then yellow, the very long slender tube densely villous at mouth; stamens 5, at first connate then spreading. Brazil. G.C. III. 57:307.

macrocarpa, Mart. Branches terete: lvs. long-petioled, linear- or ovate-lanceolate, acuminate, base acute or rounded: infl. many-fl., corymbose; fls. sessile or subsessile; calyx pilose outside; corolla-tube elongate, slender, with a papillose mouth; lobes of limb somewhat acute; ovary turbinate. Brazil. G.C. III. 57:313.

multiflora, Lem. Small tree: lvs. broad oval-oblong, base subcordate-rounded, apex abrupt acute-mucronate: infl. many-fl., in terminal subumbellate cymes; fls. long-tubed, white, erect, very fragrant and large; calyx small; corolla with 5 oblong lobes, the tips cuculate-rounded. Brazil. I.H. 16:597. G.L. 26:266.—This species has been recently referred to *P. macrocarpa*.

F. TRACY HUBBARD.

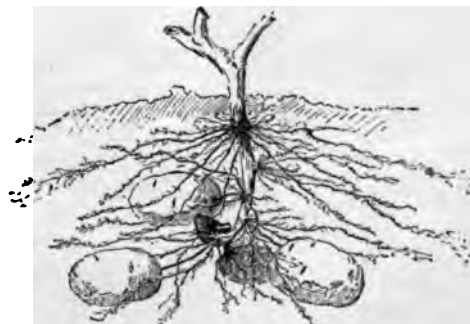
POTAMOGETON (from Greek words signifying that these are river plants). *Naiadaceæ*. PONDWEED. Fig. 640, p. 548. A rather large genus (about 100 species) of aquatic plants in temperate and sometimes in tropical regions, a few of which are sometimes grown in aquaria and ponds. Nearly 40 species are native to N. Amer. They are weedy plants, attaching themselves to the bottom in ponds, lake margins and in shallow streams, and holding their small spikes of inconspicuous fls. above the water in midsummer. In many of the species there are two kinds of lvs., the narrow submerged ones and the broad floating ones. The small perfect fls. have 4 greenish perianth-segments, 4 stamens, and usually 4 sessile 1-ovuled ovaries: fr. a nutlet with a coiled or hooked embryo. The potamogetons are very difficult plants for the systematic botanist, and it is not worth while to describe any of the species here. There is none which is generally known in the trade. They are likely to be weeds in lily-ponds. For the American species, see Morong., Mem. Torr. Club 3, No. 2; also Pflanzenreich, hft. 31. Three species have come into slight notice in American gardens: *P. crispus*, Linn., and *P. natans*, Linn., natives, and *P. densus*, Linn., European. Easily grown. L. H. B.

POTATO. One of the most widely utilized and valuable of esculent tubers, produced underground as thickened stems. It is commonly known as the "Irish," "white," or "round" potato to distinguish it from the sweet potato; botanically it is *Solanum tuberosum*. See *Solanum*.

The potato is one of the most universally cultivated plants of the United States and Canada, and it is becoming increasingly important as an article of human food. It ranks sixth in agricultural importance in the United States. This country produces, however, only about one-fifth as much as Germany. This is due to the fact that the German consumption of potatoes per capita is about two and a half times as great as ours, and that more than 50 per cent of the German crop is used either for stock-food or for conversion into starch, alcohol, or other industrial by-products. Potatoes, at present, are used very little for these purposes in this country, less than 1 per cent being so used.

The potato is closely allied, botanically, to several powerful narcotics, such as tobacco, henbane, and belladonna, and also to tomato, eggplant, and capsicum. Potatoes contain a small amount of a somewhat poisonous substance. When exposed to the direct rays of the sun and "greened," the deleterious substance is so greatly increased that the water in which they are boiled is not infrequently used to destroy vermin on domestic animals. In any case, the water in which potatoes are cooked should not be used in the preparation of other foods.

The potato is a native of the elevated valleys of Chile, Peru, and Mexico, and a form of it is found in southern Colorado. It probably was carried to Spain from Peru early in the sixteenth century. It seems to have been introduced into Europe as early as 1565. Sir Walter Raleigh, in 1585, is said to have brought back the potato from the "new country." Recent investigations, however, seem to give the credit of introducing the potato into England to Sir Francis Drake, in 1586. As *Batatas virginiana*, it was figured and described by Gerard in 1597. It is probable that these circumstances led erroneously to giving the credit of introducing the potato to Raleigh instead of to Sir John Hawkins. The wild varieties in their native habitat still bear a close resemblance to cultivated varieties except for the enlarged vine and abnormal development of the tubers in the latter. In the seventeenth century the potato was cultivated in gardens in several European countries. It was recommended by the Royal Society of London in 1663 for introduction into Ireland as a safeguard against famine. The cultivation of the potato as a field crop became somewhat common in Germany soon after 1772, at which time the grain-crops failed and potatoes were a welcome substitute for the bread-corn. It was near the middle of the eighteenth century before it acquired any real importance in Europe, outside of Ireland and a few restricted localities in other countries. As late as 1771 only a white and red variety were mentioned in one of the most important English works on gardening. The



3152. Underground parts of potato plant, showing the fibrous roots and the stems ending in tubers. The old seed-piece is seen near the bottom.

plants were enormously productive, but the tubers were poor in quality, so poor in fact that their chief use was as a food for domestic animals; and only when the bread-corns failed were they used to any extent, and even then only as a substitute. By 1840 the potato had been largely substituted in Ireland for the cereals and other similar food-crops, as the yield of potatoes in weight exceeded by twenty to thirty times the yield of wheat, barley, or oats on an equal area of land. This large dependence on a single food-crop finally resulted in a wide-spread famine. The potato blight which appeared in the United States in 1845 devastated Ireland in 1846. During two years, 1846 and 1847, a conservative estimate places the numbers who perished for want of food or from diseases caused by a meager

diet of unhealthy and unnutritious food at 600,000. By 1848 the plague had virtually disappeared.

The roots of the potato are distinct from the tubers. Usually, two to four roots start from the stalk at the base of each underground stem which, when enlarged at the end, forms the potato. (See Fig. 3152.) Roots may also start where underground stems are wanting. The potato is a perennial plant. The accumulated starch in the tubers furnishes an abundant supply of nourishment for the plants growing from the eyes or buds until they are well above the ground. So much food is stored that not infrequently small young tubers are formed on the outside of the potatoes left in the cellar during the summer. Potatoes grow from 2 to even 3 feet high, have smooth, herbaceous stems, irregularly pinnate leaves, and wheel-shaped flowers, varying in breadth from 1 to 1½ inches and in color from bluish white to

very low, good marketable tubers are not used for starch. The potato has many other uses which have been much less developed in the United States than in Europe, but there is a rapidly increasing tendency for their uses in the arts here. It is used in the textile industries, in the manufacture of woollen, linen, and silk goods; for the manufacture of potato flour, glucose, syrup, candy, desiccated potatoes for food, industrial alcohol, mucilage, dyes, stock-feed, and so forth.

The dry matter of potatoes is composed largely of starch. A high starchy content is desirable because it makes a mealy potato which is demanded in America. Being deficient in nitrogen, the potato is ill adapted for an exclusive diet and should be used in connection with food containing a high percentage of proteids, such as lean meat, peas, beans, and eggs. The lack of vegetable fats may be supplied by butter, gravy, or oatmeal. The composition of the potato varies widely. An average of 136 analyses is as follows:

	Water Per cent	Ash Per cent	Protein Per cent	Starch Per cent	Fat Per cent
Potatoes.....	78.	1.	2.2	18.	.1
Oatmeal.....	7.9	2.	14.7	67.4	7.1
Graham flour.....	13.1	1.8	11.7	69.8	1.7

The nutritive ratio of wheat is 1 to 5.37, almost perfect; that of potatoes 1 to 18.29, much too wide. Many foods in their natural state, as potatoes, are more or less deficient in mineral matter. Notable among these are rice and wheat flour—the former containing but 0.4 per cent and the latter 0.5 per cent of ash.

The main potato industry in the United States is confined to several potato-growing sections in widely separated parts of the United States. The most important of these are Aroostook County, Maine; the Norfolk and Eastern Shore trucking regions of Virginia and Maryland; the Red River Valley of Minnesota and North Dakota; the Kaw Valley of Kansas; the Greeley and Carbondale districts of Colorado; the Twin Falls country of Idaho, and the San Joaquin and Sacramento valleys of California. In these regions, the climate and soil are perfect for the best potato-production.

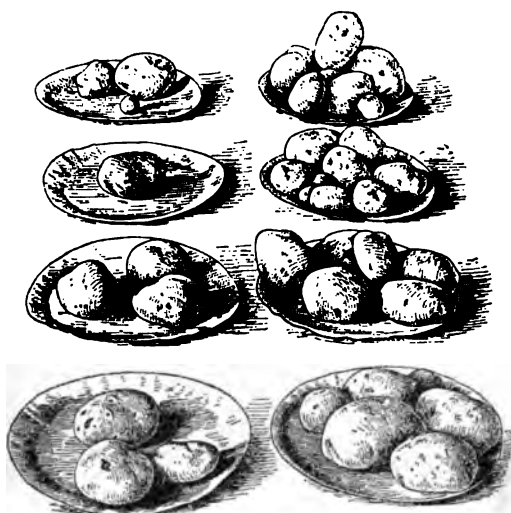
Varieties.

There are many hundred varieties of potatoes. The older varieties run out in the course of time and are supplanted by new ones. The running out is largely due to the fact that growers, as a rule, do not practise seed-selection. The new varieties are ordinarily produced either from hybridized seed or from bud-sports. The latter are somewhat common. Red tubers are now and then found in white hills, and vice versa. Other differences are taken advantage of by breeders.

Of the many varieties listed in seedsmen's catalogues and found on the market, however, only a very few are of commercial importance. Fitch, of the Iowa State College, has made a thorough trial for a number of years of all varieties of commercial importance in the United States and Europe. He also made a canvass in person and by letter of the markets of the United States. The result was that only a few varieties were found to be of much market value. He lists the following varieties as being the most valuable in the United States in order of their importance: Rural New Yorker, Green Mountain, Early Ohio, Burbank, Irish Cobbler, Bliss Triumph, Peerless (Pearl). Many other varieties, of course, have local importance and perhaps outyield the standard varieties named above.

New varieties are being produced constantly, a very few of which may prove to be better than the standard sorts, but most of them are worthless.

William Stuart, of the United States Department of Agriculture, has recently made a very comprehensive and admirably arranged classification of potatoes, as follows:



3153. Potato, to show the difference in the progeny or yield of two tubers. One tuber cut into four pieces yielded the product from four hills shown in the left-hand column; another tuber similarly cut and planted, yielded the four hills shown in the right-hand column.

purple. They bear a globular purplish or yellowish fruit or seed-ball of the size of a gooseberry, containing many small seeds. As many as 297 seeds have been found in a single seed-ball.

The cultivated potato of today has undergone a remarkable change since its first introduction into Europe by the Spaniards. Some of this change has been brought about by better cultivation, but most of it is due to breeding. The tubers of the wild *S. tuberosum* were small and attracted little attention. Heriot, in his report on Virginia, describes the plant "with roots as large as a walnut and others much larger; they grow in damp soil, many hanging together as if tied on ropes." The modern potato has been bred so that the hills contain four to six tubers of uniform size, weighing, perhaps, two pounds. (See Fig. 3153.)

The uses of the potato are wide and varied, but taking the world over, its greatest value is as a food-crop. It is probably eaten by a greater proportion of the earth's inhabitants than any other crop except rice. It is extensively used for the manufacture of starch. The great potato-growing sections of the United States, especially Aroostook County, Maine, have many starch factories, where the tubers which are oversize or undersize or otherwise not fitted for ordinary food purposes are converted into starch. The price ordinarily paid for potatoes for starch-making is considerably less than that for eating, and unless the price for eating gets

Group 1.—*Cobbler*.

Tubers: Roundish; skin creamy white. Sprouts: Base, leaf-scales, and tips slightly or distinctly tinged with reddish violet or magenta. In many cases the color is absent. Flowers: Light rose-purple; under intense heat may be almost white.

Group 2.—*Triumph*.

Tubers: Roundish; skin creamy white, with more or less numerous splashes of red, or carmine, or solid red; maturing very early. Sprouts: Base, leaf-scales, and tips more or less deeply suffused with reddish violet. Flowers: Very light rose-purple.

Group 3.—*Early Michigan*.

Tubers: Oblong or elongate-flattened; skin white or creamy white, occasionally suffused with pink around bud-eye cluster in Early Albino Sprouts: Base light rose-purple; tips creamy or light rose-purple. Flowers: White.

Group 4.—*Rose*.

Tubers: Roundish oblong to elongate-flattened or spindle-shaped flattened; skin flesh-colored or pink, or (in the case of the White Rose) white. Sprouts: Base and internodes creamy white to deep rose-lilac; leaf-scales and tips cream to rose-lilac. Flowers: White in sections 1 and 2; rose-lilac in section 3.

Group 5.—*Early Ohio*.

Tubers: Round, oblong, or ovoid; skin flesh-colored or light pink, with numerous small, raised, russet dots. Sprouts: Base, leaf-scales, and tips more or less deeply suffused with carmine-lilac to violet-lilac or magenta. Flowers: White.

Group 6.—*Hebron*.

Tubers: Elongated, somewhat flattened, sometimes spindle-shaped; skin creamy white, more or less clouded with flesh-color or light pink. Sprouts: Base creamy white to lilac; leaf-scales and tips pure mauve to magenta, but color sometimes absent. Flowers: White.

Group 7.—*Burbank*.

Tubers: Long, cylindrical to somewhat flattened, inclined to be slightly spindle-shaped; skin white to light creamy white, smooth, and glistening, or deep russet in the case of section 2. Sprouts: Base creamy white or faintly tinged with magenta; leaf-scales and tips usually lightly tinged with magenta. Flowers: White.

Group 8.—*Green Mountain*.

Tubers: Moderately to distinctly oblong, usually broad, flattened; skin a dull creamy or light russet color, frequently having russet-brown splashes toward the seed end. Sprouts: Section 1—base, leaf-scales, and tips creamy white; section 2—base usually white, occasionally tinged with magenta; leaf-scales and tips tinged with lilac to magenta. Flowers: White.

Group 9.—*Rural*.

Tubers: Broadly round-flattened to short-oblong, or distinctly oblong-flattened; skin creamy white, or deep russet in the case of section 20. Sprouts: Base dull white; leaf-scales and tips violet-purple to pansy-violet. Flowers: Central portion of corolla deep violet, with the purple growing lighter toward the outer portion; five points of corolla white, or nearly so.

Group 10.—*Pearl*.

Tubers: Round-flattened to heart-shaped-flattened, usually heavily shouldered; skin dull white, dull russet, or brownish white in section 1 or a deep bluish purple in section 2. Sprouts: Section 1—base, leaf-scales, and tips usually faintly tinged with lilac; section 2—base, leaf-scales, and tips vinous mauve. Flowers: White.

Group 11.—*Peachblow*.

Tubers: Round to round-flattened or round-oblong; skin creamy white, splashed with crimson or solid pink; eyes usually bright carmine. Includes some early-maturing varieties. Sprouts: Base, leaf-scales, and tips more or less suffused with reddish violet. Flowers: Purple.

Cultivation of potatoes.

The best soil for potatoes is a sandy loam, well drained but provided with an abundant supply of water. If the soil is deficient in moisture, the water from rainfall must be conserved by shallow cultivation. The ground should be plowed deeply and worked thoroughly so as to bring about perfect aëration. Whether the plowing should be done in the fall or the spring will depend largely upon the distribution of time and labor which the grower has at his disposal, except that hilly fields which are likely to wash during winter should not be plowed in the fall.

In cutting potatoes for planting, each eye should be supplied with an abundance of food to start the young plants vigorously. The pieces should be as large as possible and not bear more than two or three eyes. (See Fig. 3154.)

The potato is sensitive to frost, and therefore must complete its growth in most localities in three to six months. The period of development may be shortened by exposing the seed potatoes to the more or less direct rays of the sun in a temperature of about 60° for one or two weeks before planting. Some of the starch is



3154. A good cutting or seed-piece.

transformed into sugar, which causes the eyes or buds to develop into miniature short tough plants or "rosettes" which results, when the potatoes are planted, in hastening growth and shortening the period between planting and harvesting. Some varieties, when thus treated in warm rich sandy soil, produce merchantable tubers in six weeks.

The kind and amount of fertilizer which should be applied to potatoes will, of course, vary with conditions, such as method of rotation, natural fertility of the land, methods of growing the crop and so forth. The best method of rotation is one in which a crop of clover immediately precedes the potato-crop, particularly in the North. This furnishes nitrogen and leaves the ground in good mechanical condition. Ordinarily, potatoes require a fertilizer analyzing about 4 per cent of potash, 7 per cent of phosphoric acid and 10 per cent of potash. If lime is applied to the land during the rotation, it should follow the potatoes and not precede them, as it furnishes the best conditions for the development of scab, which is a serious disease. The same is true of wood-ashes which, ordinarily, contain 30 per cent of lime.

Potatoes are planted either by hand or with a machine. Good-sized tubers should be cut into about four pieces and a single piece placed in each hill. The seed-pieces should be planted soon after cutting so as to prevent "bleeding" or loss of water from the cut surfaces. The depth of planting will depend upon circumstances, but ordinarily 4 to 6 inches may be considered an average depth. The planting-machines are usually drawn by two horses and perform several operations at once. They open the furrow, distribute the fertilizer, cover it slightly so that it will not come into direct contact with the seed, drop the seed-pieces and cover them. Sometimes a heavy wheel, to act as a roller, is attached to the rear of the machine to pack the soil over the hills. By means of these machines, large acreages may be planted in a short time.

Potato fields should be given frequent and thorough tillage to keep down the weeds and conserve soil moisture. These cultivations should be shallow to prevent injury to the roots. The soil is cultivated until the plants are large enough nearly to fill the rows and have begun to "set" tubers. Further tillage is likely to injure the plants and reduce the yield.

After the plants are mature, the tubers are dug either by hand or with an elevator digger drawn by two or more horses.

Yields.

The yield of potatoes to the acre in the United States is meager, the average yield for the ten-year period 1900-1909 being 91.4 bushels. Under favorable soil and climatic conditions, with rational methods of procedure, 200 to 400 bushels are not uncommon, and under superior conditions more than 1,000 bushels to the acre have been secured. By dividing the eyes and planting them in the greenhouse in the winter, and after a little time re-dividing them, continuing this until many plants were secured, one grower was enabled to raise 2,558 pounds of potatoes in the open from one pound of seed, being an increase of more than 2,500 fold. Two other growers secured, by similar methods, 2,349 pounds and 2,118 pounds. The low average yield is due, in part, to the ravages of the many enemies of the potato plant, which, uncontrolled, sometimes destroy the crop, and usually seriously diminish the yield. In the United States, the potato is not so universally used or so productive as in Europe, though its use as a food is steadily increasing.

In common commercial culture, the yield as well as quality may be greatly enhanced by care in selecting seed. The progeny of two similar potatoes is shown in Fig. 3153, showing the inherited performance of the tubers.

The average annual production in the United States from 1881 to 1890 was 169,809,053 bushels, while the yield in 1913 was 331,525,000 bushels, which sold for an average farm price of 48.9 cents a bushel. New York stands first in potato-production, producing 53,215,000 bushels of the total yield. The crop of Europe aggregates more than the entire wheat-crop of the world. The production of the European countries for 1913 was:



3155. Potato blight. True or late blight on the left; early blight on the right.

France, 477,111,000; Austria, 424,457,000; Germany, 1,988,591,000; Russia, 1,274,439,000; the United Kingdom, 283,912,000 bushels. In 1912 the United States exported 76,382,000 bushels and imported 80,134,000 bushels.

Enemies.

The most common enemy to the potato plant, the Colorado potato-bug, is easily destroyed by applications in a powder or in a liquid of paris green or arsenate of lead to the vines when the bugs first appear. The fungus, *Phytophthora infestans*, causes the true blight (Fig. 3155), which results in potato-rot. The true blight may be kept in check by frequent and thorough sprayings with bordeaux mixture. It is always well to incorporate arsenicals with the mixture, that any remaining bugs may be destroyed. The bordeaux mixture is also useful in protecting in part the plants from the flea-beetle. Two or three applications are usually made during the summer. The early blight is more common than the true or late blight. It causes the shriveling and death of the foliage (Fig. 3155). It is usually the combined result of several causes, chief amongst which are fungi, flea-beetle, drought. Thorough good care and spraying with bordeaux mixture are the best treatments. A good potato field is shown in Fig. 3156 (adapted from "American Agriculturist"); and the picture also shows a good hand-praying rig.

A. W. GILBERT.

Potatoes as a market-garden or truck crop.

The chief difference between potatoes as a field crop and a market-garden or truck-farm crop is that in the former case they are grown in rotation with other long-season plants and consequently may occupy the ground for the entire growing season, while in the latter they occupy the ground only a few weeks and are usually preceded and followed by some early or late garden crop the same year. In the North the crop is usually grown in the spring and early summer, but in the South it may be grown either in the early spring or late fall. The spring crop is grown to supply the demand for new potatoes in the early markets while prices are high, but the fall

crop is mostly consumed locally either for table purposes or for seed for the next spring crop. In the trucking region of the upper South, the spring crop is planted in January, February, or March and harvested in May and June, and the fall crop in July or August and harvested in October or November.

The favorite Virginia rotation starts with potatoes planted in February and harvested in June. Cowpeas are sown immediately for a summer cover-crop; these are plowed under in August as a means of improving the soil, and spinach is planted in September. This crop is harvested in January or February and garden peas are planted in rows 5 or 6 feet apart. The peas are interplanted in late March with cucumbers. The peas are harvested in April and May, and the cucumbers in June and July. The ground is planted to kale in August, which is harvested in midwinter and potatoes planted again in February or March. A second two-year rotation starts with potatoes planted in February followed by cowpeas or an annual grass for forage. Winter cabbage is transplanted to the field in November or January. Corn is planted after the cabbage is harvested in May or June. Cowpeas are planted between the rows of corn at the last working. The corn-stalks remain standing in the field until late fall when the grain is harvested and they and the pea-vines are worked into the ground to supply organic matter.

Since earliness, productiveness, and reasonable resistance to disease are the main requisites for truck-farm potatoes, the varieties that meet the requirements are limited. In the South Atlantic and Gulf states, Bliss Triumph is the leading variety, while in the Carolinas and Virginia, Irish Cobbler is the favorite; but in the upper Mississippi Valley, Early Ohio undoubtedly is in the lead.

Seed grown in Maine, Michigan, Wisconsin, or other northern states will produce potatoes of marketable size five to ten days earlier than locally grown seed. Consequently truck-farmers who wish to cater to the early market depend upon the northern tier of states for their seed-supply; but those who wish to sell on the midseason market are now largely using locally grown seed. Plants from northern-grown seed suffer more severely from certain diseases than do those from local seed, hence the extreme earliness of the crop from the



3156. Spraying potatoes.

northern seed is, to a marked degree, compensated for by the healthier vines and larger yield from local seed.

The seed-stock to be used in producing the home or locally grown seed is obtained from the North in the winter or early spring, and held in cold storage until July or August, when it is planted. The tubers are harvested after the vines are killed by frost in October or November, and are placed in farm storage until needed for planting.

The land should be broken with a turn-plow a month or six weeks in advance of planting the potatoes, if the preceding crop in the rotation will admit. It is best to apply the stable-manure to some preceding crop in order that it may be well decayed before the tubers are planted. After the ground is thoroughly harrowed, the rows should be marked out about 3 feet apart. If drainage is not good it is well to open the furrow with a small turning-plow in order to expose a large surface to the action of the sun, air, and frost. A few days before planting, the furrows should be reopened, the fertilizer required distributed in them. It should be thoroughly mixed with the soil to prevent its coming into direct contact with the seed-tubers when they are planted.

In forcing potatoes, especially in the cooler season of the year, it is customary to use from 1,500 pounds to 2,000 pounds of fertilizer analyzing 5 to 6 per cent nitrogen, 6 to 7 per cent phosphoric acid, and 5 per cent potash, to the acre. The potatoes will not use all of this, but that remaining after they are harvested is available for subsequent crops. About one-third of the nitrogen in the fertilizer should be obtained from nitrate of soda and sulfate of ammonia and the other two-thirds from high-grade tankage, blood, and fish-scrap. By using nitrogen from the sources mentioned, the plants are enabled to obtain a constant supply throughout their growing-season. The phosphoric acid is obtained from acidulated South Carolina rock, and the potash, preferably, from sulfate of potash. Some growers apply about 1,000 pounds of the fertilizer in the rows before the tubers are planted and the balance as a side or top dressing when the plants are well started.

Whether the potatoes are to be planted by hand or a power planter, it is better to apply the fertilizer before planting, as much better distribution may thus be obtained. The larger number of truck-farmers follow the practice of hand planting, but the larger growers are now using horse-power machines. From three to five barrels of northern-grown seed and from two to three barrels of home-grown seed are usually required to plant an acre. The seed-pieces are placed 14 to 16 inches apart in the rows and are usually placed from 2 to 4 inches below the surface-level of the ground. The hand-planted tubers are covered by turning two furrows over them with a small turn-plow, thus forming a ridge 8 or 9 inches high above the tubers. If the discs of the power planter do not form such ridges, it is customary to add additional soil with the plow. These high ridges protect the seed-tubers against unfavorable weather conditions and enables them to develop strong roots before the sprouts appear above the ground, thus insuring rapid development when the season opens.

As soon as the tubers have formed sprouts an inch or two long, a light harrow is dragged diagonally across the ridges to kill any weeds that may be starting, and to provide a mulch over the row. A second dragging is given a week or ten days later, or just before the sprouts appear above the surface. The first working with the cultivator is given as soon as the plants have the row well outlined; subsequent cultivations are given at intervals of a week or ten days, a small quantity of soil being worked against the plants, thus forming low ridges at the later cultivations. If proper attention is given to the early cultivation, little or no hoe work need be expected.

The season for harvesting depends more upon market conditions than upon the maturity of the crop. If prices are high, digging may be started when the yield will not be over thirty or forty barrels to the acre, but if prices are moderate with indications for a steady demand, harvesting may be delayed for two or three weeks. In the meantime the yield will have increased from 25 to 50 per cent.

The crop is usually turned out of the ground with a plow while the vines are still green. The vines are then

pulled out of the ground with most of the tubers attached. These are carefully pulled from the roots, the others picked out of the loose soil and placed into piles on the ground. They are then graded by hand and packed in barrels for shipment. Great care is used in handling the new potatoes to prevent unnecessary bruising.

Mechanical diggers have not given satisfaction in the trucking region of the South, primarily because they bruise and break the skin, thus causing the tubers to present discolorations when placed on the market.

T. C. JOHNSON.

POTATO, AIR: *Dioscorea bulbifera*. P. Onion: Onion. P., Sweet: Sweet Potato, and *Ipomoea Batatas*.

POTENTILLA (diminutive of Latin *potens*, powerful; referring to the medicinal properties). *Rosaceæ*. CINQUEFOIL. FIVE-FINGER. A large group of perennial, rarely annual, herbs and shrubs found throughout the North Temperate and frigid zones; somewhat planted.

Leaves compound: appendages of the calyx 5, borne at the base of the 5 sepals, which in turn are borne upon the edge of a cup-shaped, dry receptacle; stamens 10-30, together with the 5 rounded petals inserted upon the margin of the receptacle (perigynous); pistils many, in fr. becoming minute achenes; style deciduous. Those in cultivation are all hardy perennial plants



3157. Potentilla, one of the hybrid garden forms known as *P. coccinea*; of the *P. atrosanguinea* group.

suitable for border planting. The most valuable double-fl. forms are hybrids. Monograph by T. Wolf, *Biblioth. Bot.* Heft 71:1908.

The American potentillas are generally rather unattractive plants with small flowers. They are, as a rule, very tenacious of life and do well with ordinary care. *P. fruticosa*, a handsome and distinct low shrub, prefers moist positions, but will grow in even very dry soil. When thoroughly established in moist soil, it is difficult to eradicate. *P. argentea* should be given a dry soil, preferably about rocks. It is tenacious of life and is rather attractive. *P. Hippiana*, a western species with comparatively large foliage of decided gray color, is hardy East. It is a good perennial, preferring dryish

soil. *P. tridentata* is an attractive evergreen species forming thick mats. It does well in any fairly rich soil in open or partially shaded positions. Potentillas are propagated by division or seed, the hybrids only by division. *P. fruticosa* may be increased by greenwood cuttings. (F. W. Barclay.)

Hybrid potentillas (Fig. 3157) have nearly all the good qualities in a border plant,—handsome foliage and free-blooming habit. They continue in bloom from spring until autumn, although most profusely in June and July. They cannot be said to be reliably hardy in the latitude of Boston, probably not above Washington. They do not grow over 2 feet and seldom need staking. A heavy soil suits them best. Choice varieties are propagated by division of the rootstock in spring; cuttings will not root. They run mostly in shades of maroon, scarlet, and orange, often beautifully banded with yellow. They bear seed freely, and when carefully hybridized one may get a very fine strain with a good proportion of double blooms. Seedlings bloom the second year. Some of the species make neat rock-plants, especially *P. tridentata*, *P. verna*, and *P. argentea*,—the last, though common, is valuable in places in which other plants will not grow. (T. D. Hatfield.)

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ARTIFICIAL KEY TO THE SPECIES.

- A. St. distinctly shrubby, diffusely branched..... 1. *fruticosa*
- AA. St. herbaceous or merely suffrutescent.
- B. Basal lvs. pinnate, 5-7-foliolate.
- C. Lvs. white-tomentose, at least beneath.
- D. Fls. cymose: lfts. whitened both sides..... 13. *Hippiana*
- DD. Fls. lateral, solitary at the nodes: lfts. usually green above.
- E. Carpels dorsally furrowed: peduncles and sts. pilose; tomentum lustrous..... 31. *Anserina*
- EE. Carpels dorsally rounded: peduncles and sts. glabrate; tomentum dull..... 32. *pacifica*
- CC. Lvs. green both sides.
- D. Fls. white, rose, or dark purple; infl. more or less lax, diffusely cymose; petals exceeding the sepals.
- E. Lfts. round-elliptic or rhombic-ovate: carpels glabrous, smooth or rugulose: infl. glandular..... 10. *rupestris*
- EE. Lfts. oblong or cuneate-oblong or oblong-lanceolate: infl. not glandular.
- F. Carpels densely pilose: petals large, obovate, showy. 2. *Salesoviana*
- FF. Carpels glabrous: petals minute, ovate-lanceolate. 3. *palustris*
- DD. Fls. creamy yellow; infl. congested; petals not longer than the sepals..... 11. *arguta*
- DDD. Fls. bright yellow.
- E. Lfts. minute, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, dissected: petals shorter than the sepals..... 33. *Gordonii*
- EE. Lfts. large, 1 in. long or more, dentate or incised..... 12. *glandulosa*

- BB. Basal lvs. palmately 5-7-foliolate.
- C. Fls. white: lvs. white-silky or glaucous beneath..... 9. *alba*
- CC. Fls. yellow.
- D. Lvs. white-woolly or white stellate-canescens, at least beneath.
- E. Caudex with abundant rooting stolons: sts. scarcely exceeding the basal lvs., pilose with long horizontal yellowish hairs: lvs. canescent..... 29. *cinerea*
- EE. Caudex without stolons: sts. much exceeding the lvs., without the above hairs.
- F. St. 16-28 in. high: fls. 7-9 lines broad..... 14. *gracilis*
- FF. St. 6-16 in. high: fls. 4-7 lines broad..... 21. *argentea*
- DD. Lvs. green beneath, or somewhat silky.
- E. Fls. lateral, solitary at each node..... 30. *canadensis*
- EE. Fls. terminal and solitary or cymose.
- F. Lfts. large, 2-5 in. long: plants large.
- G. Infl. glandular: lvs. rugose, coarsely serrate-dentate..... 22. *recta*
- GG. Infl. glandless: lvs. not rugose, laciniolate-pinnatifid..... 23. *laciniosa*
- FF. Lfts. small, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long: plants low.
- G. Style conical: fls. 1 in. broad..... 25. *pyrenaica*
- GG. Style clavate: fls. 5-12 lines broad.
- H. Stipules of basal lvs. broadly ovate or ovate-lanceolate: stolons scarcely elongated, clothed with dead stipules..... 27. *alpestris*
- HH. Stipules of basal lvs. linear, elongated: stolons much elongated, rooting, not clothed with dead stipules..... 28. *verna*
- CCC. Fls. purple or rose.
- D. Lvs. and sts. velvety with yellowish hairs: lvs. almost tomentose beneath..... 17. *hæmatochrus*
- DD. Lvs. and sts. not yellowish hairy: lvs. green both sides.
- E. Lfts. 5: petals clear purple with dark veins and dark spot at base: infl. not glandular..... 15. *nepalensis*
- EE. Lfts. mostly 7: petals dark purple: infl. glandular..... 16. *Thurberi*
- BBB. Basal lvs. palmately, or rarely pinnately, 3-foliolate.
- C. Fls. rose, white, or creamy white.
- D. Lfts. glabrous, or slightly stri-gose beneath, 3-toothed: fls. white..... 4. *tridentata*
- DD. Lfts. white-silky on both sides, 3-toothed or entire: fls. rose, rarely white..... 8. *nitida*
- DDD. Lvs. tomentose at least beneath; teeth several.
- E. Petals white or cream, narrow, cochleate, and dorsally villous..... 7. *speciosa*
- EE. Petals purple or red, broadly obovate, glabrous..... 19. *atrosanguinea*
- CC. Fls. yellow.
- D. Lvs. white-tomentose beneath, white-silky above (see also *P. grandiflora*).
- E. Margin of lfts. incised-serrate: fls. 1-1 $\frac{1}{4}$ in. broad..... 18. *argyrophylla*
- EE. Margin of lfts. crenate-serrate: fls. $\frac{3}{4}$ -1 in. broad..... 20. *villosa*

- DD. Lvs. not tomentose beneath.
 E. Lfts. 3-toothed at apex..... 5. *ambigua*
 EE. Lfts. several-toothed.
 F. The lfts. small, $\frac{1}{2}$ in. long
 or less: fls. 3-6 lines
 broad..... 26. *dubia*
 FF. The lfts. larger: fls. $\frac{3}{4}$ in.
 broad or more.
 G. Achenes pilose..... 6. *eriocarpa*
 GG. Achenes glabrous, either
 smooth or rugose..... 24. *grandiflora*

Section I. TRICHOCARPÆ. Carpels completely or in part pilose (except *P. palustris*): receptacle long- and dense-pilose.

Subsection A. RHOPALOSTYLÆ. Style clavate.

1. *fruticosa*, Linn. St. shrubby, much branched, mostly 1-4 ft. high, with peculiar shreddy bark: lvs. all cauline, pinnate; lfts. 3-7, small, 6-12 lines long, oblong-linear, acute, silky, with revolute margins: fls. numerous, bright yellow, showy, 8-16 lines broad; receptacle, carpels, and disk all long-hairy; style sub-basal, clavate. June-Aug. Boggy or dry, more or less calcareous soil, Eu., Asia, N. N. Amer. J.H. III. 31:602. —A useful shrub, flowering throughout the summer. Var. *Vilmoriniana*, Bean, has lvs. silvery white beneath and fls. creamy white. Var. *albicans*, Rehd. & Wilson, is similar but has yellow fls. China, and cult. Var. *dahurica*, Lehm., is white-fl. L.B.C. 10:914 (as *P. glabra*). Var. *Veitchii*, Bean, white-fl., is *P. fruticosa* × *P. dahurica* (*P. Friedrichsenii*, Spaeth). B.M. 8637. In nature, *P. fruticosa* runs into many forms.

Subsection B. NEMATOSTYLÆ. Style filiform.

Series A. SUFFRUTICULOSÆ. Suffruticose: fl.-bearing sts. terminal on the determinate plant axis.

2. *Salesoviana*, Steph. Sts. 12-24 in. high, woody at base, laxly cymose above, and silky villous: stipules broadly scarious, fuscous: basal lvs. pinnate; lfts. 7-9, rarely 5, lower much smaller, all short-petiolulate, oblong or cuneate-oblong, coarsely and sharply serrate, thick or subcoriaceous, green and glabrous above, pale appressed pilose below, often furfuraceous and canescent: fls. $1\frac{1}{4}$ in. broad; sepals purple outside, yellowish within, twice as long as the appendages; petals broadly obovate, entire, about equaling the sepals, lilac or white suffused with rose; carpels villous; style lateral, filiform. June-Aug. Asia. B.M. 7258. —A beautiful and striking plant of dry stony places.

3. *palustris*, Scop. (*Comarum palustre*, Linn.). Suffruticose: stolons long, creeping and branched: aerial sts. ascending, 8 in. to 2 ft. long, glabrous, laxly cymose above and more or less pilose or glandular: basal lvs. pinnate, long-petioled; lfts. 2-3 pairs, contiguous, thick, not veiny, sessile, oblong-lanceolate, 1-3 in. long, evenly and sharply serrate, green above, glaucous beneath, often puberulent, rarely silky: fls. few; sepals dark purplish, large; petals small, ovate-lanceolate, acuminate, pale purple, often villous or ciliate, shorter than the sepals; receptacle spongy; carpels glabrous; style lateral, filiform. June-Aug. Very wet marshes, Arctic and Temp. Eu., Asia, and N. Amer. —A striking species for aquatic gardens.

4. *tridentata*, Soland. Caudex somewhat woody: sts. 1-12 in. high, slender: branches erect-spreading, appressed-pubescent: lvs. mostly basal, long-petioled, ternate; lfts. $\frac{1}{2}$ -2 in. long, oblanceolate, truncate and 2-3-toothed at apex, cuneate and entire below, coriaceous, dark green, glabrous or strigose and paler beneath: fls. several, small, 3-5 lines broad, in a terminal, nearly naked cyme; petals oval, entire, exceeding the calyx, white; carpels villous; style sub-basal, long-filiform. June-Aug. Rocky places, N. E. N. Amer. —Good for dry banks and rockeries.

5. *ambigua*, Camb. Sts. slender, subrepent or ascending, tufted and branched, woody below: lvs. ter-

nate; lfts. subcoriaceous, lateral sessile, terminal long-stalked, obovate or orbicular-cuneate, nearly as broad as long, coarsely and obtusely 3-toothed, green above, glaucous beneath, appressed pilose on both sides or subglabrous: fls. solitary on the branches, long-peduncled, $\frac{3}{4}$ -1 in. broad; peduncles strigose; appendages and sepals subequal; petals suborbicular, slightly retuse, much exceeding the sepals, yellow; carpels pilose. July, Aug. Himalayas.

6. *eriocarpa*, Wall. Caudex branched, woody: fl.-sts. flaccid, simple, ascending, 4-8 in. long, almost leafless, sparsely pilose or subglabrate, 1-2-fld.: basal lvs. ternate or pinnately 3-foliate; lfts. more or less long-stalked, obovate-rhomboid, coarsely and sharply 5-7-toothed above, green both sides, subglabrous: fls. conspicuous, $1\frac{1}{2}$ in. broad, long-peduncled; appendages broad, usually longer than the sepals; petals round-ovate, much exceeding the sepals, soft yellow with large orange blotch; carpels long-pilose; style subterminal, filiform or slightly swollen at the middle or above. July, Aug. Himalayas. —Showy for borders and rockeries.

Series B. HERBACEÆ. Herbaceous: fl.-bearing sts. lateral on the indeterminate plant axis.

7. *speciosa*, Willd. Caudex thick, branched, woody: fl.-sts. ascending, 2-10 in. long, few-lvd.: basal lvs. ternate, long-petioled; lfts. thick, obovate, terminal slightly stalked, all crenate-dentate above base, with short teeth, white-tomentose on both sides or only below: fls. 3-8, short-pedicelled, 7-9 lines broad; appendages narrow; sepals rather obtuse; petals scarcely exceeding the sepals, long-canaliculate-unguiculate, terminating in a very small ovate-cochleate limb, tardily deciduous, white or yellowish white, dorsally ciliate or more or less villous; carpels pilose; style subterminal, slender, not dilated. June-Aug. S. Eu.

8. *nitida*, Linn. Cespitose; caudex subligneous: fl.-sts. ascending, short, 1-2 in. long, usually not exceeding the lvs., apex 1-2-fld.: peduncles often glandular: basal lvs. ternate (rarely 4-5-nate), short-petioled, crowded; lfts. thick, sessile, oblong-obovate or sub-cuneate, apex with 3 incurved teeth, rarely entire, densely white-silky on both faces: fls. conspicuous, 9-12 lines broad or more; appendages narrow, shorter than the purple sepals; petals very short-clawed, broadly obovate, emarginate, twice as long as the sepals, rose or lilac, rarely white; filaments and anthers purple; carpels pilose; style subterminal, long, slender, purple. July, Aug. Mountains of S. Eu. —“One of the most beautiful of alpine fls.”

9. *alba*, Linn. Caudex thick, branched: fls.-sts. short, not exceeding the basal lvs., weak, decumbent, laxly 2-5-fld., sericeo-villous: basal lvs. long-petioled, 5-foliate, some often ternate or 7-foliate; lfts. sessile or short-stalked, all symmetrical but the outer shorter, oblong-lanceolate, apex acute and serrate, teeth few, appressed, terminal smaller, green and glabrous above, more or less densely white-silky, becoming glabrous and glaucous beneath: fls. long-peduncled, showy, 9-12 lines broad; appendages very narrow, shorter than the sepals; petals broadly obcordate, somewhat longer than the sepals, white; carpels pilose; style subterminal, slender. April-June, and often Aug.-Oct. Cent. Eu. G. 37:98.

Section II. GYMNOCARPÆ. Carpels glabrous: receptacle short-pilose to almost glabrous.

Subsection A. CLOSTEROSTYLÆ. Style subbasal, fusiform.

10. *rupëstris*, Linn. Caudex thick, subligneous: sts. erect, 20 in. high or more, few-lvd., dichotomously branched and laxly corymbose above, glandular-hairy and hirsute: basal lvs. long-petioled, pinnate; lfts. 2-4 pairs, decreasing downward, distant, round-elliptic or rhombic-ovate, lateral sessile, terminal sessile or

stalked, margin irregularly biserrate, pilose and green on both faces, often glandular: fls. $\frac{1}{4}$ –1 in. broad, long-pedicelled; appendages much shorter and narrower than the sepals, often bi- or trifid; petals obovate, entire, equaling or much exceeding the sepals, white; carpels smooth or rugulose; style subbasal, glandular-thickened in the middle. May–July. Eu., Asia, and mountains of W. N. Amer.—Grows well in dry soil.

11. *arguta*, Pursh. Similar to *P. rupestris*, but with a more strict habit, more glandular-hirsute pubescence, more congested infl., and smaller cream-colored petals which scarcely exceed or are shorter than the sepals; calyx enlarging more in fr., and receptacle becoming elongated, much swollen and almost fleshy. June–Aug. N. Amer.—Good for dry rocky soil.

12. *glandulosa*, Lindl. Similar to *P. rupestris* and *P. arguta*: differs from the former in its golden yellow or pale yellow fls., and from the latter both in the color of the fls., and in the dichotomous and laxly cymose infl. June–Aug. W. N. Amer.—Grows well in dry sterile ground.

Subsection B. CONOSTYLE. Style subterminal, conical.

Series A. ERIOTRICHÆ. Plant with some true tomentum.

13. *Hippiana*, Lehm. St. erect, 1–2 ft. high, silky, laxly cymose above: basal lvs. rather large, pinnate; lfts. 3–5 pairs, whitish-silky above, white-tomentose beneath, uppermost somewhat confluent, the others decreasing regularly toward base of lf., obovate-cuneate, 1–2½ in. long, obtusely incised-toothed: fls. $\frac{1}{4}$ –1 in. broad; appendages nearly equaling the calyx, acute; petals obovate, retuse, slightly exceeding the sepals, bright yellow; carpels glabrous, rugose; style papillose-thickened at base, tapering above to the enlarged stigma. June, July. W. N. Amer.

14. *gracilis*, Douglas. Erect and rather tall, about 2 ft. high, more or less white-hairy, erect-branched and cymose-paniculate above: basal lvs. long-petioled, digitate; lfts. 5–7, obovate or oblanceolate, 1–2 in. long, deeply and regularly incised-dentate, sparsely pilose or glabrous and green above, white-tomentose beneath: fls. 6–9 lines broad, showy; petals obcordate, exceeding the acuminate sepals, yellow; carpels glabrous and smooth; style subterminal, slender, thickened at the base. June–Aug. W. N. Amer.

15. *nepalensis*, Hook. (*P. formosa*, Don. *P. Tönquei*, Hort.). St. stout, erect or ascending, 1–2 ft. high, purple: the branches laxly paniculate or raceme-like, hirsute, not glandular: radical lvs. long-petioled, palmately 5-foliolate, often 12 in. long; lfts. oblong-obovate, 2–3 in. long, veiny and rugose, crenate-serrate except toward the base, with broad and short sub-acute teeth, green both sides, sparsely appressed-pilose: fls. long-pedicelled, showy, 9–12 lines broad; calyx purple within; petals broadly obcordate, deeply emarginate, nearly twice the length of the sepals, clear purple with darker veins and dark-purple base; carpels glabrous, rugulose; style subterminal, thickened at the base, tapering above. July, Aug. Himalayas.—The branches elongate zigzag-like during the summer. A fine species.

16. *Thürberi*, Gray. Similar to *P. nepalensis*, but finely glandular-hairy all over: lvs. mostly 7-foliolate; petals dark purple and scarcely exceeding the sepals: infl. more cymose. June–Aug. New Mex. and S. Calif.—Good for border planting.

17. *hæmatóchrus*, Lehm. St. stout, ascending, 8–16 in. high, densely cymose above, pubescent or canescent with yellowish hairs: basal lvs. with long and stout petioles, palmately 7-, rarely 5-foliolate; lfts. oblong-obovate, obtuse, thick, elevated-veiny beneath, crenate-serrate with small teeth, velvety above with yellowish subappressed hairs, more or less densely

white-tomentose below: fls. on thick pedicels, 9–10 lines broad; sepals purple within; petals broadly obcordate, longer than the sepals, dark purple; carpels glabrous, smooth; style subterminal, red, much thickened at the base. June–Aug. Mountains of Mex.—The yellowish pubescence is characteristic.

18. *argyrophylla*, Wall. (*P. insignis*, Royle). Sts. erect, 8–16 in. high, nearly simple, leafy, cymosely few-fld., above puberulent and whitish tomentose: basal lvs. large, long-petioled, mostly ternate; lfts. subsessile, broadly obovate or elliptic-ovate or obovate-oblong, more or less rugose beneath, coarsely incised-serrate with acute teeth, more or less densely silky above, rarely subglabrate, densely white-tomentose beneath: fls. long-pedicelled, showy, 1–1¼ in. broad; petals broadly obcordate, twice the length of the sepals, yellow; carpels glabrous, smooth; style subterminal, greatly thickened at the base. June–Aug. Himalayas.—This species and the next are two of the most common species in cult., and are extensively hybridized with each other and with *P. nepalensis*, giving rise to most of the hybrid potentillas of the trade. (Fig. 3157.)

19. *atrosanguinea*, Wall. Similar to *P. argyrophylla*, but larger, more branched, lvs. less heavily silky-glossy and less white-tomentose beneath, usually more bluntly toothed: petals, stamens, and styles dark purple. June–Aug. Himalayas.—Parent of many garden forms.

20. *villosa*, Pall. Sts. stout, ascending, 4–12 in. high, few-lvd., cymosely few-fld., densely silky-villous: basal lvs. long-petioled, ternate; lfts. sessile or nearly so, thick and veiny, suborbicular-cuneate, 9–15 lines long, lateral oblique at the base, all coarsely crenate-serrate with short teeth, margin somewhat revolute, densely silky-pilose above, densely white-tomentose beneath: fls. 9–12 lines broad, showy; sepals and bracteoles equal; petals broadly obcordate, 2–3 times the length of the sepals, golden yellow; carpels glabrous, smooth or rugulose; style subterminal, conical, moderately thickened at the base. June, July. Arctic Asia and N. W. Amer.—Showy, with beautiful lf.-rosettes.

21. *argentea*, Linn. Sts. several, ascending, rarely prostrate, slender, 4–20 in. long, laxly paniculate or corymbose above, white-tomentose: basal lvs. long-petioled, palmately 5–rarely 7-foliolate; lfts. broadly cuneate-obovate, 4–14 lines long, coarsely and regularly incised-dentate with 2–5 pairs of teeth, margins revolute, from green and glabrous to densely silky or tomentose above, densely white-tomentose beneath, very rarely tomentose and green beneath: fls. long-pedicelled, 5–7 lines broad; petals obovate, emarginate, scarcely exceeding the sepals, sulfur-yellow; carpels glabrous, rugulose; style subterminal, conical, papillose-thickened at the base. June–Aug. or Oct. Eu. and Asia, intro. in N. Amer.—Good for dry, sterile soil. Var. *calabra*, Sir. (*P. calabra*, Ten.). Lfts. dilated-fan-shaped, incised on outer edge, whitened on both sides: plant low: sts. stout, declined, condensed-cymose: fls. relatively large. Italy.

Series B. ORTHOTRICHÆ. Plant with no true tomentum; pilose and often glandular.

22. *recta*, Linn. Sts. stout, erect, strict, 12–28 in. high, leafy, dichotomously much branched and widely corymbose above, hirsute or pilose and pubescent, and more or less glandular: basal lvs. large, long-petioled, palmately 5–7-foliolate; lfts. 2–4 in. or more long, the outer smaller, all usually sessile, oblong, linear-oblong or oblong-obovate, regularly and coarsely serrate-dentate, green both sides, villous and rugose, thin: fls. 8–12 lines broad; petals obcordate, deeply emarginate, equaling or somewhat exceeding the sepals, yellow to golden yellow; carpels glabrous, very rugose; style swollen at the base. June, July. Eu.—Very handsome and showy. Var. *sulphurea*, Lam. Petals sulfur-yellow, much exceeding the sepals: sts. and lvs. lighter

green. Widespread in Eu. Intro. as a weed in E. N. Amer.

23. *laciniata*, Waldst. & Kit. (*P. laciniata*, Amer. Hort.). St. stout, erect, forming clumps, 12-20 in. high, mostly reddish, laxly corymbose above, long-pilose with soft spreading hairs: basal lvs. palmately 7-foliate, rarely 5-foliate; lfts. green and pilose on both surfaces, not rugose, the terminal folded, all oblanceolate-oblong, 2-3 in. long, lacinate-pinnatifid, with 6-12 pairs of lanceolate or linear and incised teeth: fls. and general habit as in *P. recta*, to which it is closely related. S. Eu.

24. *grandiflora*, Linn. Sts. ascending or erect, from a thick caudex, 4-15 in. high, the erect branches of the cyme few-fl., densely villous above, eglandular: basal lvs. long-petioled, mostly ternate; lfts. 7-15 lines long, lateral obliquely obovate, terminal cuneate-obovate, all incised-serrate toward the apex with 6-10 ovate or oblong acutish teeth, pubescent above, densely short-villous beneath, veiny, rarely whitened: fls. conspicuous, 9-15 lines broad; petals broadly obcordate, emarginate, much exceeding the sepals, golden yellow; carpels glabrous, smooth or obsoletely rugose; style papillose-thickened at the base. July, Aug. Alps.—A good border plant.

25. *pyrenæica*, Ram. St. stout, arcuate-ascending from a thick subcespitose caudex, 4-10 in. long, racemously few-fl. above, pilose or somewhat canescent: basal lvs. both short- and long-petioled, palmately 5-foliate; lfts. small, sessile, cuneate-obovate or cuneate-oblong-obovate, 4-9 lines long, the outer smaller, all entire below, dentate toward apex with 5-7 pairs of short acutish or obtuse teeth, green and subglabrous above, densely pilose and subsericeous beneath: fls. 1 in. broad; petals large, broadly obovate, emarginate, much longer than the sepals, golden yellow; carpels glabrous, striate-rugulose; style thickened below. July, Aug. Pyrenees.—Closely related to *P. grandiflora*.

Subsection C. GOMPHOSTYLE. *Style subterminal, rarely lateral, clavate: plant with no true tomentum.*

26. *dubia*, Zimm. Cespitose, forming mats, runners wanting: sts. slender, prostrate or ascending, $\frac{3}{4}$ -2 in. long, scarcely as long as the lvs., 1-fl., rarely 2-3-fl., pilose, eglandular: basal lvs. short-petioled, ternate; lfts. small, 4-5 lines long, broadly obovate, the outer strongly oblique, the terminal slightly petioled, all with 2-3 pairs of ovate, acute, or obtuse teeth, light green and glabrous above, strigose on the veins beneath: fls. small, 3-6 lines broad; appendages broad, obtuse or rounded; petals broadly obovate, slightly emarginate, exceeding the sepals, yellow; carpels glabrous, smooth or rugulose; style somewhat thickened below. July, Aug. Mountains of Eu. G. 36:483.—The smallest of European potentillas.

27. *alpestris*, Hall. f. Caudex densely clothed with stipules; runners almost wanting: sts. slender, arcuate-ascending, rarely strict, few-lvd., 2-8 in. long, somewhat exceeding the basal lvs., laxly dichotomous-ramose at top, pilose above, rarely glandular: basal lvs. short-petioled, appendages 5-foliate, rarely 3- or 7-foliate; lfts. mostly sessile, obovate, crenate-dentate or deeply incised-serrate with 2-5 pairs of obtuse teeth, strigose or glabrous above, pilose or villous on the veins beneath, green both sides: fls. long-pedicelled, $\frac{1}{2}$ -1 in. broad; petals broadly obovate, emarginate, more or less exceeding the sepals, golden yellow, rarely paler, often with an orange spot at the base; carpels glabrous, rugulose or smoothish; style subterminal, clavate. June-Sept. Arctic and Alpine Amer., Eu., and Asia.—A close relative of *P. verna* but not forming such extended mats. Extremely variable.

28. *verna*, Linn. Caudex emitting runners, forming a thick turf: sts. numerous, decumbent or ascending,

2-6 (rarely 12) in. long, dichotomously branched and laxly corymbose, pilose, rarely glandular, usually reddish: basal lvs. long-petioled, palmately 5-foliate, rarely 7-foliate; lfts. sessile or nearly so, cuneate-obovate, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, toward the apex crenate-dentate to deeply incised-serrate, sparsely pilose and green above, green and pilose beneath: fls. long-slender-pedicelled; appendages oblong, obtuse; petals obovate to broadly obcordate, emarginate, longer than the sepals, golden yellow, rarely paler; carpels glabrous, rugose; style subterminal, clavate. March-May, often also Aug., Sept. Eu.—Very variable. Dry or stony soil. For banks and rockeries.

29. *cinerea*, Chaix. Forming mats: sts. slender, ascending, 2-4 in. high, scarcely exceeding the basal lvs., few-fl.; basal lvs. palmately 5-foliate, rarely 3-4-foliate; lfts. narrowly cuneate-oblong-obovate or nearly oblong, rounded at apex, short-crenate-dentate, thick, rugose, sparingly stellate-tomentose above, densely so beneath, long-hirsute on both faces; appendages dilated and often bifid, scarcely shorter than the ovate, obtuse sepals; petals oblong-obovate, pale yellow, much exceeding the sepals; carpels glabrous, rugose; style subterminal, clavate. April-June. Alps.



3158. *Potentilla Anserina*, showing a plant in early summer before the runners start. Later the flowers are borne on the runners.

30. *canadensis*, Linn. Sts. slender, at first ascending, later prostrate and creeping, simple, flagelliform, 12-24 in. or more long, leafy, bearing solitary long-peduncled fls. at the nodes, villous, eglandular: basal and cauline lvs. slender-petioled, palmately 5-foliate; lfts. cuneate-obovate or oblong, coarsely dentate-serrate except at the base, green both sides, pubescent or glabrate above, more or less strigose-pilose beneath: fls. 5-6 lines broad; appendages narrowly lanceolate; petals broadly obovate, slightly emarginate, yellow, longer than the sepals; carpels glabrous; style subterminal, from clavate to fusiform. May-Aug. E. N. Amer. Mn. 3:38.—Good for dry, sterile, open soil.

Subsection D. LEPTOSTYLE. *Style lateral, short-filiform, of equal diam. throughout: plant with or without tomentum.*

31. *Anserina*, Linn. SILVER-WEED. Fig. 3158. Caudex thick; sts. simple, slender, prostrate and creeping, rooting at the nodes, often 2 $\frac{1}{2}$ or 3 ft. long, bearing solitary, long-peduncled fls. at the nodes, pilose-sericeous with ascending or somewhat spreading hairs: basal lvs. numerous, large, pinnate, mostly short-pedicelled; lfts. many pairs, decreasing in size downward, with minute ones interspersed, linear-oblong to oblong-ovate, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, sharply serrate, green or whitened above, densely white to lustrous silky-tomentose beneath, very rarely green both sides: fls. large, 8-10 lines broad;

appendages usually lobed; petals obovate, entire, exceeding the sepals, golden yellow; carpels at maturity glabrous, thick, ovoid, corky, dorsally furrowed; style lateral, filiform. May-Aug. Gravelly, more or less calcareous shores. Most widespread of all potentillas, through the cold and temperate portions of all countries except possibly Afr.—Very decorative.

32. *pacifica*, Howell. Similar to *P. Anserina*; but sts., peduncles, petioles, and rachis glabrous or early glabrate: lfts. dull-tomentose beneath: achenes laterally compressed, firmer, rounded on the back, not furrowed. Along the coast of temperate and arctic E. and W. Amer., and E. Asia.—This species may be in the trade as *P. Anserina*.

33. *Gordonii*, Baill. (*Ivesia Gordonii*, Torr. & Gray. *Horkelia Gordonii*, Hook.). Caudex stout, woody, and cespitose: sts. erect, 4-12 in. high, and, like the lvs., glandular-pubescent or glabrous: lvs. pinnate, mostly basal, numerous; lfts. 10-20, divided into 3-5 oblong or linear segms.; cauline lvs. few, very small: fls. small and inconspicuous, in a crowded cyme; petals yellow, spatulate, shorter than the sepals; stamens 5-20, inserted on the edge of the cup-shaped receptacle at a distance from the carpels; style filiform, basal. Subalpine W. U. S.—Forms dense mats in dry soil. This species belongs properly to *Horkelia* (a genus apparently not known to the gardeners) and is generically distinct from *Potentilla* because of the more deeply cup-shaped receptacle. It is, however, known in the trade as a potentilla.

Following are some of the hybrid potentillas, the exact botanical status of which has not been worked out and which have not been standardized as to nomenclature: *P. bicolor* (*P. argyrophylla* × *P. atrosanguinea*, according to Wolf), orange and vermilion.—*P. cardinale* (*P. atrosanguinea* × *P. nepalensis*, according to Wolf), brilliant cardinal.—*Dr. André*, golden yellow suffused with vermilion.—*Eldorado*, purple suffused with yellow.—*Emile*, bright bronzy red.—*Gloire de Nancy*, golden yellow.—*Hamlet*, dark carmine.—*P. Hopwoodiana* (*P. nepalensis* × *P. recta*, according to Wolf). Lfts. 5-6; petals at base deep rose, at center pale rose, margins whitish.—*P. hybrida*, name applied to various hybrids. R.H. 1890, p. 305. Gn. 16:462; 25:514.—*Jeanne Salter*, orange, shaded scarlet.—*Le Vesuve*, floriferous, light red margined with yellow or scarlet.—*P. Mac Nabiana* (*P. argyrophylla* × *P. atrosanguinea*, according to Wolf).—*Mars*, dark velvety red.—*M. Daudin*, beautiful amber.—*O'Briana*, pink and salmon.—*P. perfecta*, maroon, shaded lemon.—*P. purpurea*, deep purple.—*P. varicolor*, carmine and yellow-flaked.—*Victor Lemoine*, light red striped with yellow.—*Wm. Rollinson*, mahogany-brown, suffused with orange.

The status of the following trade names cannot be determined: *P. amena*, *P. caudicatum*, *P. cincolor*, *P. lanuginosa*, *P. minima*, *P. nassensis*, *P. splendens*.

K. M. WIEGAND.



3159. *Pothos aureus* of the horticulturists. (×1/2)

POTERIUM (Greek for *drinking cup*; because the foliage of one species was used in the preparation of a medicinal drink). *Rosaceae*. Linnæus placed certain rosaceous plants in the genera *Poterium* and *Sanguisorba*, the latter having precedence of publication. Many subsequent authors have united these genera. Focke, however (Engler & Prantl, *Die Natürlichen Pflanzenfamilien*), re-defines the genus *Poterium* to include one species, the *P. spinosum* of S. Eu., allowing the other species to remain in *Sanguisorba*. As thus understood, *Poterium* is monœcious, the lower fls. in the spike staminate, the upper pistillate, the stamens many and hanging, the styles 2, the fr. somewhat fleshy, colored, and inclosed in the calyx, the lvs. pinnate. These plants are known as burnet, although the name applies more correctly to *Sanguisorba* alone. *P. spinosum*, Linn., is a small spiny shrub with nearly glabrous serrate lfts., somewhat downy branches, small greenish fls. in oblong spikes and reddish berry-like fr. It is offered in S. Calif. Grows 3 ft., the branchlets ending in spines. Said to be a very interesting ornamental undershrub. Recently *P. obtusum*, Franch. & Sav. (*P. obtusatum*, Hort. *Sanguisorba obtusa*, Maxim.), has been offered abroad: it is from Japan, said to be the finest of the burnets yet introduced: 3 ft.: lvs. long, pinnate, lfts. about 6 pairs, oblong, rounded at end, serrate, petioluled: fl.-sts. much branched, the crimson spikes about 3 in. long and 1 in. diam. Summer. G.C. III. 59:2. For *P. canadense* and *P. Sanguisorba*, see *Sanguisorba*. L. H. B.

POTHOS (*Potha* is said to be a Ceylonese name). *Araceæ*. Tall-climbing branching shrubs (more or less herbaceous as known in cultivation) of the oriental tropics.

Leaves thick and often shining, entire or lobed, sometimes blotched or variegated: fls. small and perfect, crowded on a spadix, with 6 perianth-segms. and 6 stamens, the ovary 3-loculed and with a rounded or mushroom-like sessile stigma: fr. a 1-3-seeded berry: spathe usually persistent and wide-spreading or deflexed at maturity. *Rhaphidophora* has an oblong or linear stigma.—About 50 species. Several names are in the hort. trade, but not all of them belong to *Pothos*. In fact, the genus *Pothos* is very ill-defined in cult. because species are named before fls. and frs. are known and determinations are often wrongly made. Some of them are to be referred to *Scindapsus* and others perhaps to *Rhaphidophora*. The species of *Pothos* send out cord-like roots that cling to damp walls. For *P. argyrea*, see *Scindapsus pictus* var. For monograph, see Engler, *Das Pflanzenreich*, IV. 23 B (1905). They are warmhouse foliage plants and require the same general treatment as *Philodendron*.

A. Lvs. green, not banded or mottled.

nitens, Bull. Lvs. obliquely ovate-acute, cordate at base, shining purplish green; needs further botanical definition. *Malaya*.

AA. Lvs. mottled or banded.

aureus, Lind. Fig. 3159. Strong evergreen climber with cordate-ovate-acute lvs., which are variously blotched and mottled with yellowish white, the body color being bright green. Solomon Isl. I.H. 27:381. S.H. 1:334.—The generic position of this plant—which is one of the commonest ones in cult.—is in doubt. It probably belongs to *Scindapsus* so treated by Engler. In a dark place the handsome markings of the lvs. tend to disappear. Branches will grow in water for a time. Prop. by cuttings or layers.

argenteus, Bull. Lvs. obliquely ovate-acuminate, silvery gray, with a deep green margin and a deep green band along the midrib; needs further definition. *Borneo*.

P. celatocaulis, N. E. Br. = *Monstera latevaginata*.—*P. Loureiri*, Hook. & Arn. Climbing, branched, with aerial roots: petioles 4-5

in. long, linear, flat; blades decurved, much shorter than petiole, linear-lanceolate, acuminate: spathe 1½-2 in. long, linear to linear-lanceolate; spadix stipulate, 2-4 in. long, cylindric, green: berries smooth, scarlet, about ⅜ in. long. S. China. B.M. 7744.

L. H. B.

POTHUAVA: *Æchmea*.

POT MARIGOLD: *Calendula*.

POTS. Of the three firms of interest to horticulturists that are eligible to the Century Club because of one hundred years or more in the same business, are A. H. Hews & Co., potters, and J. M. Thorburn & Co., of New York, and D. Landreth & Co., of Philadelphia. This indicates the age of the flower-pot business in this country.

The first entry in the oldest Hews account book reads as follows: Weston, April 19, 1775, Lemuel Jones, to Ware, debtor: 0£ 2s. 8d. From 1788 to 1810, a period of twenty-one years, there is a continuous account. The charges within that entire term cover about as many pages as are now often entered in a day; and the amount in dollars and cents does not compare with single sales of the present time. Through all the years up to 1807 the term "flower-pots" does not once appear, and it is much to be regretted that the first sale of flower-pots and the name of the purchaser cannot be found.

In 1861, after war was actually declared, business conditions were much depressed. The members of the Hews firm felt sure that there would be no demand for flower-pots, they being more of a luxury than a necessity, and that the factory must close. At that time the writer succeeded in securing permission to make his first venture as salesman "on the road." Going first to C. M. Hovey, he secured what was a good order for those times, some 10,000 or more pots for the spring trade of 1862. Not once after that, during the Civil War, was the firm able, in the spring and fall rush, to fill all their orders for flower-pots. It is not that these orders were remarkably large or numerous, but they were beyond the capacity of the firm. In 1866, prices were a third or a half higher than they are today. The firm first got fairly under way with machinery for making small flower-pots in 1869.

Until about 1864 or 1865, common flower-pots throughout the world had always been made by hand on the potter's wheel. There have been, indeed, many different forms of this wheel, but it had always been propelled by hand- or foot-power. When, in the early fifties, a wheel was made to be propelled by the foot, with two sizes of pulleys and a balance-wheel whereby the speed of the wheel was increased in the proportion of three to one, it was thought that perfection had been reached. Much time, though very little money, had been spent previous to the fifties in attempts to make a pot machine. It was left to William Linton, of Baltimore, an experienced practical potter, to perfect and patent the first machine. From him two machines were purchased and the exclusive right to use them in Massachusetts. In a short time great improvements were made on his patent. America was far ahead of Europe in this kind of machinery, as also in improved machinery in general. The machine made only small pots, up to about 5 inches in diameter; and while it had previously taken an experienced man to make his thousand 3-inch pots in ten hours, a smart boy without any previous experience whatever could make 3,000 on the machine in the same time.

When the standard pot was adopted, about twenty-five years ago, the hand-process was practically abandoned in the principal potteries in favor of what is technically called the jigger. This is a revolving disc propelled by machinery. These discs, or jigger-heads, are made of different sizes and fitted with various rings. Plaster molds are made in very large numbers for each size of pot, and the larger standard pots (6- to 12-inch)

are all made at the present time in these molds. The old methods have now passed.

The making of the pot is not its only cost: previous to that comes the preparation of the clay. The hundred years from 1765 to 1865 saw no improvement in the process of preparing it for use. It was ground in a wooden tank or tub, propelled by an ox. The various other processes remained as crude in 1865 as they had been the century previous: the drying, firing, and all connected with the manufacture. The capacity of our flower-pot drying-rooms of today far exceeds the



3160. Pots of various sizes. All are "standard" pots except the rimless one at the right, which is a "rose pot."

entire product of any one year prior to 1865. At that time the custom of using wood for drying and firing pots still continued. It required three cords of white pine and from thirty to forty hours' labor thoroughly to fire a small furnace. Today three tons of bituminous coal will fire five times as much pottery in fifteen hours.

Grades of clay used in the manufacture of flower-pots are almost as numerous as the banks in which they are found, and require many different methods of treatment. To separate the stones from the clay has always been a very perplexing as well as expensive problem. The clay is first plowed by means of a horse and capstan, whereby one horse will do the work of twenty men with picks. This clay is then loaded in dump-carts and carried to the mill, where it is shoveled through a disintegrator, which expels the larger stones and crushes the smaller ones. It then falls on an endless belt and is carried to a revolving drier. This is a western device, with which, by the use of crude petroleum for heat, from 20 to 25 per cent of moisture is evaporated from the clay, and while it passes through a direct blaze of white heat there is sufficient moisture all the time to prevent it from burning. (Burning of the



3161. Fern-pans. A form of pottery useful for small bulbs and many shallow-rooted subjects of which spreading masses are desired.

clay at this stage would make it worthless.) To demonstrate this point beyond question, paper and dry shavings have been passed through with the clay, and they came out without even scorching.

From the drier, the clay goes into large bins, where it must remain twenty-four hours, so that portions of it which have become too dry and hard may absorb the moisture from that not dry enough. From these bins it is carried to whippers, which beat the clay without further crushing the stone. From the whipper it goes to the revolving screens, and thence to the elevators.

The next process is mixing, or, as it is termed, "pug-

ging." This is all done by machinery. From one machine the clay comes out very soft and plastic, to be worked in plaster molds. From the other the clay comes out into hard cubes for the iron molds of the machine. The pot machine and the jigger of today each does the work of six to eight men at the wheel.

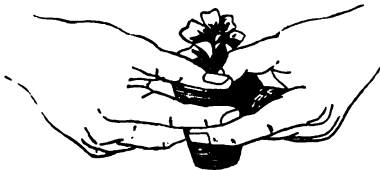
The difference in cost between a good and a poor pot is very slight, and if the florist will demand and accept nothing but a first-class pot, a standard in quality as well as size will soon be reached. To be standard in quality a pot must be of clay properly prepared, be of uniform firing, and of a smooth surface inside as well as out. It must also be of right porosity, a condition which can be attained by the proper mixture of clay. Moreover, a machine-made pot should have a smooth rim on the inside, so that the man standing at his bench potting thousands of plants a day, as is being done constantly in large establishments, may have flesh remaining on his thumbs at night. Such a pot must also be able to stand transportation and years of usage if necessary. "Standard" flower-pots, such as are now used by American florists, are shown in Figs. 3160, 3161.

A. H. Hews.

POTSHERDS. Gardener's name for broken pots and crocks, a material used in the bottom of pots, pans, boxes, and the like, to provide drainage. Coal-clinkers, gravel, and other inert materials, are often used for the same purpose.

POTTING. The first stage in the life of the plant is when the seedling is transplanted from the seed-bed or the cutting is put in the cutting-bench. It is only when either is potted that it can truly be said to take on the dignity of a plant. It is then out of swaddling clothes and enters the ranks of its big brothers and sisters, on the way to making its bow in society; to live perchance in the window of the tenement or on the fire-escape; mayhap to refresh the eye of the patient in the sick-room; or to lose its identity in rows of its fellows in great glass houses where the blossoms are garnered and sent to market; perhaps to take its place in row upon row of its kind and make an arabesque pattern or gay border, and so delight the eye or regale the senses with sweet odors.

The mechanical operation of potting includes also "shifting," i. e., transferring the plant from a small to a larger pot. Repotting signifies the same, generally speaking, as shifting; but speaking technically it means shaking out an established plant and putting it in a pot of the same size or one smaller, according to its needs. The actual operation of potting is very simple, and yet it must be well done to give the young plant a fair start



3162. Potting a cutting. The moment when the thumbs come into play.

in life. Careless potting is responsible for many losses in plants. The larger part of rooted cuttings and seedlings should be potted in 2-inch pots, and it is essential, particularly in the case of rooted cuttings, that it be done at the proper stage of development of the roots. When the roots are from $\frac{1}{8}$ to $\frac{1}{4}$ inch long they may be said to be at their best for potting. If sooner, the plants are not likely to develop so rapidly in the pot as if left in the cutting-bench; if later, they are harder to handle, injury is liable to result, and they do not so readily recover from the shock incident to the change.

The operation of potting as practised in commercial florists' establishments is as follows: The soil having been prepared, the workman places the empty pots at his left hand, the cuttings in front of him, and an empty "flat" to receive the potted plants at his right. With a simultaneous movement he takes an empty pot in his left hand and a handful of soil in his right. He "sets" the pot in front of him, fills it with soil, and while doing so reaches for the cutting, retaining a small portion of soil in his hand. With the index finger of the right hand he makes a hole in the center of the pot of soil, inserts the cutting, drops the portion of soil which he retained in his right hand into the hole, takes the pot between the index and middle fingers of both hands to steady it and obtain leverage, places his thumbs on each side of the cutting and parallel with his body (Fig. 3162), the right on the side away from his body, the left on the other side, and presses evenly and firmly; then shifts his thumbs so that they are at right angles with his body and presses again; transfers the potted plant with his right hand to the "flat," placing it with a little force to level the loose soil on top, reaching for another empty pot with his left hand as he does this, and repeats the movements. It is marvelous how rapidly these motions are made by expert workmen, and the work can be done as well rapidly as slowly when the cuttings are in the proper condition as to root-development already described. There was a time when 5,000 a day of ten hours was considered the maximum, and it is still good work for the average workman. James Markey, an employee of the late Peter Henderson, repeatedly potted 10,000 verbena cuttings with two boys to assist in taking away the plants as potted, supplying him with empty pots and cuttings, the requisite quantity of soil having been previously placed on the bench. The writer was his only assistant when he made his first great effort at "breaking the record," when he succeeded in potting 7,500 in ten hours. Upon one occasion he potted 11,500 verbena cuttings in a day of ten hours, which is the highest number ever reached. At a potting contest held in Madison Square Garden in New York city in 1892, George Martin potted 1,373 cuttings in one hour, the material used being arborvitae cuttings without roots. The "standard" pots (Fig. 3160) cannot be handled so rapidly as those without rims, for the reason that the lower edges of the rim are sharp and rough and make the fingers of the workman sore. Consequently the pots without rims are to be preferred.

The essentials in good potting are to put the cutting in the center of the pot and at the proper depth, to firm the soil thoroughly and evenly, and to leave $\frac{1}{4}$ inch, or a little less, between the top of the soil and the upper edge of the pot to receive water.

Included in potting is the care of the plants immediately after being potted and until they have taken root in the pots. First in importance is the "setting" of the plants on the bench; care should be taken that they are "set" perfectly level so that they will hold water. They should be watered thoroughly and shaded as soon as they are set. The best method of shading when large quantities are potted is by the use of lath shutters. These are made by nailing common laths on three parallel pieces of furring strip, allowing 1 inch space between the laths. They may be made any length, 3 feet being a very convenient size. Inverted pots of a sufficient height to clear the young plants make very handy supports for these shutters. During late spring and summer it will be necessary to supplement this method of shading by covering the shutters with paper or muslin, the muslin being preferred. Sew the muslin in 10-yard lengths, giving pieces 2 yards wide. Sprinkle the muslin copiously at intervals as it becomes dry. This care must be kept up for three to six days according to conditions; the shutters should be put over the plants early in the morning, first watering the plants; an hour or so later

the muslin should be put on, provided the sun is shining brightly. After the second day the period for covering the plants should be shortened by putting shutters and muslin on later and taking them off earlier until the plants are sufficiently established to get along without them. An important detail is to have about $\frac{1}{2}$



3163.
Implement
for firming
the soil in
large pots.

inch of sand on the bench to retain moisture and allow for the proper "setting" of the plants. Another very important detail, in case new pots are used, is thoroughly to saturate them with water before filling, allowing sufficient time for the water to evaporate from the surface before using. It is bad practice to work with wet pots, and worse still with wet soil. A good test of the proper amount of moisture in soil for potting is when it molds in the hand only under strong pressure. Another essential, in case old pots are used, is to see that they are clean inside at all events; they should be clean outside as well, but if any old soil is found adhering to the inside of the pot it should be cleaned out and thrown away.

Potting large plants from the open ground, such as carnations, roses, geraniums, and shrubs, is an entirely different operation from the foregoing. These all require pots 5 inches in diameter and over, and sufficient pressure cannot be given with the thumbs properly to firm the soil. It is necessary, therefore, to use a stick about an inch wide, and sharpened down to $\frac{1}{4}$ inch at the end. (Fig. 3163.) The handle should be round, and in a large place where much heavy potting and shifting are done it pays to have some of these sticks in regular tool stock. After the plant is placed in the pot and the latter filled with soil, take the stem of the plant at the surface between the index fingers and thumbs, the other fingers extended down the sides of the pot, lift the pot about an inch and set it back with a smart shock, at the same time pressing the plant down and steadying it; this settles the soil considerably in the pot. Next take the stick described above and run it around the inside edge of the pot twice or so to pack the soil, add more soil to fill up, finish by pressing evenly and firmly the entire surface with the thumbs, allowing $\frac{1}{2}$ inch of space between the surface of the soil and the upper edge of the pots to hold water. What has been said about new and clean pots applies with even greater force to large pots.

The potting of orchids is a radically different operation from the potting of purely terrestrial plants, about which the preceding has been written. Consider cattleyas as an example: being epiphytes, they do not require soil in which to grow; put them in as small pots as possible. The material for potting best suited to these and



3164. Potting an orchid. The pot is cut in two to show the proper conditions inside.

most orchids is fibrous peat and live sphagnum moss in equal proportions, adding a small portion of broken charcoal. If freshly imported pieces are to be potted, cut away all the old dead roots, pseudobulbs and leaves. If the formation of the piece is uneven, it should be cut in two, so as to combine the parts thus separated into a more symmetrical whole, with the growths pointing to the center. Have the pot thoroughly clean, fill it about half with clean "corks" and small pieces of charcoal, adjust the piece in the center of the pot,

distributing evenly any roots which remain; but first spread a layer of moss over the "corks," then press the preparation of peat and moss evenly and moderately firm around the piece and in the interstices between the roots, finishing up high around the center; insert some small-sized stakes at the proper places to support the piece, tie the growth to them, and the job is finished. Fig. 3164 will show better than words can describe how the plant should look after it is potted.

Repotting, when necessary, is almost identical in its details with potting itself. The spring is the best time to do it, even with species which flower in autumn. Carefully remove all the old corks and other



3165. "Shifting" an established plant into a larger pot.

material, so as not to injure the roots, a pointed stick being the best implement for the purpose. Then replace as carefully with new material in a clean pot. The undersigned dwells upon cleanliness repeatedly, for herein lies the great essential in successful plant-growing. Potting orchids in baskets, which sounds paradoxical, is identical with potting them in pots as far as the essential details of manipulation are concerned. The potting of bulbs is discussed under *Bulb*.

"Shifting" is the technical term used in the florist's trade when plants are transferred to larger pots. (See Fig. 3165.) When the plant exhausts the soil in the small pot it must be put in a larger one to maintain growth. The trained eye detects at a glance by the appearance of the plant when it requires a "shift." Those lacking such training can discover it by turning the plant out of the pot and examining the roots. (See Fig. 3166.) If the outside of the ball of soil on the lower portion is well netted with roots as in Fig. 3167, and particularly if most of them have lost the fresh creamy white color of healthy "working" roots, then the plant must be at once shifted, or it will soon reach that stage which is the bane of the careless plant-grower, viz., "pot-bound."

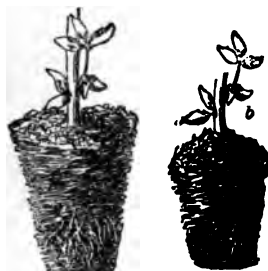
"Knocking out" is the technical term used by florists to describe the turning of a plant out of a pot. The best way to do this is to take the pot in the right hand, invert it in passing it to the left, as the plant should be placed between the index and middle fingers of the left hand, give the pot a smart tap on its rim on the edge of the bench and the ball of soil is separated from the pot; place the plant in a flat ready for the purpose, and repeat. One tap is all that is necessary in ninety-nine cases out of a hundred. It is bad practice to get into the habit of giving a series of taps, as it makes slow work. We are considering now the first shift, i. e., from a 2-inch to a 3-inch pot.

The plants having been knocked out, the next operation is to "shoulder" them. This consists of removing



3166. A plant may be turned out of its pot to ascertain whether it needs a "shift."

the shoulder or edge of the ball of soil with the thumb and forefinger down to where the roots begin. (Fig. 3167.) The object of this is obvious, to remove leached-out soil and supply a fresh, nutritious portion in its place, so as to get the greatest possible advantage from shifting. Everything being made ready, the operator proceeds by

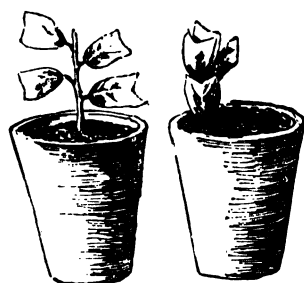


3167. Repotting a sickly plant. The "shoulder" is rubbed off as at b, replaced by fresh soil and the whole ball of earth reduced in size. (Only a fraction of the plant's height is shown.)

putting a portion of soil in the bottom of the pot sufficient to raise the ball of soil flush with the edge of the pot. As this is being done, reach for the plant with the left hand and put it in the center of the pot; simultaneously take a handful of soil in the right hand and fill the pot, then grasp the pot between the index and middle fingers of each hand, place the thumbs on each side of the plant at right angles with the body, lift the pot about $\frac{1}{2}$ inch and set it back on the bench with a smart rap, pressing with the thumbs at the same time; change the thumbs to right angles with their former position and press again, then change so as to press where they have not touched already; three pressures of the thumbs and the rap on the bench, and the operation is done. A smart operator with two boys will shift 5,000 plants in ten hours. This amount of work is made possible only by eliminating all unnecessary motions and making them synchronous with each hand in reaching for soil, pot, and plant as described. One hand should not be idle while the other is employed. See Figs. 3168-3172 for good and bad examples of potting.

Be careful in shifting not to set the plants too deep. The tendency of roots is downward, and only enough of the stem to steady the plant in the pot should be in the soil. Plants set too deeply in the pots are easily over-watered, because so much soil is not within the influence of root-action. A few plants which root from the crown, like lilies, should be set deeper than such plants as roses, geraniums, fuchsias, palms, and all plants whose root-action is mainly downward.

Do not give too great a shift at one time; that is, do not attempt to shift from a 2-inch pot to a 5- or 6-inch. As a rule, an inch at a time is best, especially for commercial purposes, where plants are grown to be shipped



3168. Good and bad potting. The cutting should be placed in the center.

some distance. In private places soft-wooded plants may be shifted in spring from 2- to 4-inch pots and from 4- to 6-inch, as the question of shipping does not enter. But it would not be safe even with these to do the same in late fall when growth is slower and the days are growing shorter. Hard-wooded plants, such as palms, azaleas, and the like, and even roses should never be shifted

more than an inch at a time; in fact, it is better not to shift them later than September in any case. The spring is the best time to do it.

Drainage is necessary in all pots over 4 inches and for hard-wooded plants even that size is better drained. This is technically called "crocking," i. e., placing pot-

sherds in the bottom of the pot to allow the quick passage of water and admit air to the roots. Place a large piece over the hole in the bottom of the pot and the remainder in smaller pieces. There are usually enough broken pots around a place to supply the needs. Charcoal is an excellent material for supplying pot-drainage, none better. An inch or so of drainage is sufficient in a 5- or 6-inch pot, 2 inches or so for all sizes above



3169. Too deep.



3170. Too high.

these. A bottom of broken stone, cinders or gravel is essential upon which to stand the pots, as such a stratum accelerates drainage, while at the same time providing a moist surface so beneficial to plants in a greenhouse.

A few words of caution may not be out of place before closing this branch of the subject. Never shift plants while the ball of soil is wet; it should be dry enough to crumble readily to the touch. Never shift into dirty pots; it will pay to clean them, especially the inside. Never shift a pot-bound plant without loosening the soil on the surface of the ball. A few smart raps with the closed fist will do it; or better still repot as now described.

Repotting is necessary frequently when plants have become pot-bound, or when from any cause they appear to require it; such, for instance, as debility from over-shifting, over-watering or neglect of any kind. In such cases the soil should be washed from the roots almost entirely and the plant put into a pot a size or two smaller than it has been growing in, taking care to firm the soil well, and if a shrubby plant prune it back according to its needs and conditions. Shade such plants until danger of wilting is past and water sparingly until new and vigorous growths appear, showing that the subjects have regained their normal health.

There are a few cultural details intimately associated with potting which may with profit be added as a closing paragraph. The high narrow pot shown on the extreme right of the line of pots in Fig. 3160 is frequently used for roses and palms by some, especially for *Cocos Weddelliana*, which makes a long tap-root and which it is almost invariably fatal to break. It is feasible, however, to avoid this if the seeds are sown in 6-inch pots, using 4 inches of clinkers as a bottom. These check the downward growth and induce development of fibrous roots in the soil, so that the tap-root may be cut off below them and the ordinary 2-inch pot used with safety. It is not necessary to use the deep pot for roses in any case. Plants which exceed the diameter of the pot should be given room to allow for development. The best market growers plunge the pots in soil to half their depth, as it is necessary in the spring months because of the rapid evaporation of water. This refers especially to geraniums, fuchsias, heliotropes, petunias, and the like. Care must be taken, however, to lift them occasionally so as to prevent the roots from getting hold in the soil through the hole in the bottom of the pot. Ten inches apart from center to

center for such plants will not be too much if stocky plants well set with good flowers are wanted; and in these days such plants will bring enough in the best markets to pay for the space and trouble. For 2- and 3-inch pots use sifted soil, but for 4-inch and over, soil well broken, but having plenty of fiber from sod in it, should be used. Always water plants thoroughly after



3171. Pot too full.

3172. Good.

shifting so as to soak the soil to the bottom, and do not water again until they show dryness half way down the pot on the outside.

PATRICK O'MARA.

POURRÉTIA: *Puya*.

POURTHILÆA: *Photinia*.

POUTÈRIA (native name). *Sapotaceæ*. Trees or shrubs with small often short-peduncled fls. in clusters: corolla with 4 rounded lobes and a tube about twice as long; staminodes free, petal-like, borne at the edge of the tube; stamens borne at the base or middle of the tube, becoming free; ovary swollen at base, hairy, 2-4-celled, gradually produced into the long style: fr. a 1-4-seeded berry, hairy or glabrous, occasionally pointed.—About 30 species in Trop. Amer. *P. sudavis*, Hemsl. Tree with rather slender flowering branches: lvs. crowded at the ends of the branches, narrow-oblong to lanceolate, about 4 in. long, coriaceous: fls. very small in fascicles borne in the axils of the fallen lvs.: fr. pear-shaped with a thin edible pericarp possessing a delicate perfume. Uruguay. Intro. into gardens abroad.

PRÀTIA (named after Prat-Bernon, with Freycinet's voyage). *Campanulacææ*. Slender prostrate or creeping herbs, rarely ascending or erect, sometimes grown for ornament.

Leaves alternate, toothed: infl. axillary, in 1-fl. peduncles; fls. rather small, often unisexual; calyx-tube adnate to the ovary, 5-parted; corolla oblique, split to the base at the back, 2-lipped, upper lip 2-parted, lower lip 3-lobed; stamens 5, 2 lower tipped with short bristles, 3 upper naked; ovary 2-celled: fr. a globose or obovoid berry.—About 30 species, mostly from Austral. and New Zeal., but also in S. E. Asia and S. Amer. Several species seem to be more or less extensively cult. abroad. The genus is very closely related to *Lobelia* and similarly cult., differing from it in the indehiscent more or less succulent fr. They are used both as greenhouse and hardy herbaceous rockwork plants, depending on the species.

angulata, Hook. (*Lobelia littoralis*, Cunn.). Fig. 3173. Perennial herb, very variable, slender, creeping or prostrate, glabrous or sometimes slightly pubescent: sts. 12-18 in. long: lvs. short-petiolate, orbicular or ovate-oblong to obovate: fls. white with purple streaks: berry globose or broadly ovoid, purplish red. New Zeal. G. 34:757. G.M. 53:897. G.C. III. 47:98. J.H. III. 71:57.—Hardy in England and used as a creeper for

rockwork. Var. **arenaria**, Hook. f. (*P. arenaria*, Hook. f.). Lvs. larger, obscurely toothed: peduncles very short. Auckland Isls.—Well adapted for shady localities; a quick-growing creeper with many white, star-like fls.

begonifolia, Lindl. Small, creeping, rooting, and pubescent: lvs. cordate-ovate, denticulate: fls. green, marked pink: berry short-ellipsoid, finally smooth, black. India, Malaya. B.R. 1373.—Sometimes grown in the greenhouse.

repens, Gaud. Creeping: lvs. petiolate, rather reniform, undulately subrenate: peduncles rather long, axillary, 1-fl.; fls. white with a violet tint. June-Oct. Falkland Isls.—Hardy in England; well adapted for a sunny position on rockwork.

P. ilicifolia, Hort., listed abroad as a charming little creeping plant with evergreen foliage studded through all the summer months with large pure white fls. followed by large lilac-colored berries, and loving a damp spot, is unknown botanically.

F. TRACY HUBBARD.

PRÉMNA (Greek, *stump* of a tree in allusion to the low sts. of most species). *Verbenacææ*. Shrubs, subshrubs or trees, sometimes climbing: lvs. opposite, entire or dentate: cymes paniced or corymbose; fls. often polygamous; calyx small, cup-shaped, subequal or 2-lipped; corolla tubular, throat hairy, limb 2-lipped, 5-lobed or subequally 4-lobed; stamens 4, didynamous; ovary 2- or 4-celled, 4-ovuled: drupe small, surrounded below by the calyx, globose or oblong-obovoid.—About 80 species, inhabitants of the warmer regions of the Old World. *P. Gaudichaudii*, Schau. Branches puberulent: lvs. long-petiolate, broad-ovate, short-acuminate, entire: infl. terminal, corymbose panicles, many-fl.; fls. small; calyx short cup-shaped, subbilabiate; corolla subequally 4-lobed. Marianne Isls. This is known as "ahgao" and is said to be extensively used in Guam for the construction of buildings. The following E. Indian species have occasionally been cult. in hothouses abroad: *P. esculenta*, Roxbg., has yellowish white fls. in May and purple fr.: st. grows about 6-8 ft. high; *P. integrifolia*, Linn., with greenish white fls. in July, about 10-12 ft. high, and *P. latifolia*, Roxbg., with dirty white fls. in June, growing about 15 ft. high.

PRENANTHES (Greek words, meaning *drooping blossom*). *Compositææ*. **RATTLESNAKE ROOT**. Tall perennial herbs, a few species of which are offered by collectors for use in wild-gardens.

Leafy-stemmed, with dull-colored heads borne in spike-like terminal panicles: lvs. alternate, lower ones

3173. *Pratia angulata*. (X 1/2)

petiolate, sagittate, cordate, often much divided; upper ones auriculate and much narrower and smaller: heads 5-30-fl.: achenes terete, 4-5-angled, usually striate.—About 16 species, of which 10 are native of N. Amer. (The N. American forms are by some botanists separated as *Nabalus*.) The species are extremely variable. They are of easy cult. in any good soil, but are very weedy and of little importance horticulturally.

A. *Involucre glabrous.*

B. Heads 5-7-fld.; involucre very narrow, only 1 line thick.

altissima, Linn. A variable species, mostly perfectly smooth: st. 3-7 ft., slender: lvs. membranous, all stalked, ovate, heart-shaped: fls. greenish yellow; pappus straw-colored or whitish. July-Oct. In open or shade, Canada to Ga. and Tenn.

BB. Heads 8-16-fld.; involucre broader, $1\frac{1}{2}$ -3 lines thick.

c. *Pappus deep cinnamon-brown.*

alba, Linn. St. 2-5 ft. high, usually smooth and glaucous or purplish: lvs. angulate or somewhat triangular halberd-form, the uppermost usually undivided: infl. thyrsoid-paniculate; fls. dull white. Aug., Sept. Open woods and sandy soil, Canada to Ga. and Ill. B.B. 3:289. Mn. 3:161.

cc. *Pappus straw-colored.*

serpentaria, Pursh (*Nabalus Fraseri*, DC.). St. usually about 2-4 ft. high, sometimes purple-spotted: fls. purplish, greenish white or yellowish. July-Oct. Ont. to Fla. and Ky. B.B. 3:289.—Little known in cult. and usually only a weed as a wild plant.

AA. *Involucre hirsute-pubescent.*

racemosa, Michx. St. 6 in. to 2 ft. high: st.-lvs. mainly sessile, while they are mostly petiolate in the other species here described: fls. purplish. Aug., Sept. Moist open places, Canada to N. J. and Colo. B.B. 3:291.

F. W. BARCLAY.

N. TAYLOR.†

PRESTŌEA (named after H. Prestoe, of the Botanic Gardens at Trinidad). *Palmaceæ*. Slender dwarf palms with a reed-like, annulate caudex, occasionally grown in the warmhouse: lvs. long and slender-petioled, pinnatisect at the base, upper segms. connate in an oblong blade, 2-cleft at the apex, lower segms. narrow: spathes 2, membranaceous, finally lacerate; spadices short-peduncled, fuscous-pubescent, with strict erect-spreading branches: fls. small, monœcious; male fls. asymmetrical, calyx 3-lobed, minute, petals obliquely ovate, stamens 6, ovary rudimentary; female fls. larger than the male, globose, sepals reniform-rotundate, petals broadly ovate, ovary obovoid-oblong, 1-celled. Three species, W. Indies and Colombia. *P. pubigera*, Hook. f. (*Hyospathe pubigera*, Griseb. & Wendl.). Trunk 10-12 ft. high: lvs. 3-4 ft. long, green with pale nerves, glabrous; lower segms. somewhat distant, linear-acuminate, $1\frac{1}{2}$ -2 ft. long, upper more or less cohering and forming oblong or oblong-linear blades: exterior spathe 2-keeled, 5 in. long, interior 12-15 in. long; lower branches of spadix about 6 in. long, thickened at base, glomerules somewhat distant: fls. minute and sessile. Trinidad.

PRESTŌNIA (named for Dr. Charles Preston). *Apocynaceæ*. Tall climbing pubescent or glabrous shrubs, among which is *P. venosa*, a tender foliage plant once offered in America as *Echites nutans*.

Leaves opposite, with a few well-separated pinnate veins: cymes often densely corymbose or almost umbelliform, pseudo-axillary; calyx nearly 5-parted with 5 entire or lacerated scales inside at the base; corolla salver-shaped with 5 linear erect scales below the throat, which is constricted, 5-lobed; ovary 2-carpelled, ovules numerous in each carpel: follicles hard, erect or divergent at base.—About 30 species, natives of Trop. Amer.

Prestonia venosa is cultivated for the network of crimson veins on its foliage. The plant blooms rarely, and its flowers are inferior to *Echites* or *Dipladenia*. When properly cultivated it makes a charming subject, but if neglected it is as worthless as a weed. It can hardly be propagated by cuttings; the fleshy roots are cut into pieces 1 to 2 inches long. The plant demands a temperature of 85° F., with an atmosphere as moist as possible. Foliage should never be syringed.

Young plants should be raised every season, as older plants become unsightly. The plant was formerly considerably grown, being trained to a balloon-shaped wire trellis. Needs warmth to bring out the markings.—From Lowe's "Beautiful Leaved Plants."

venosa, Mottet (*Echites nutans*, Anders. *Hæmadiyton venosum*, Lindl.). Lvs. opposite, ovate-lanceolate, villous beneath: fls. yellow, in pedunculate panicles; corolla-lobes roundish, wavy. St. Vincent in the W. Indies. B.M. 2473. Lowe 58.

F. TRACY HUBBARD.†

PRICKLY ASH: *Xanthoxylum*. P. Comfrey: *Symphytum aspernum*. P. Pear: *Opuntia*. P. Poppy: *Argemone*.

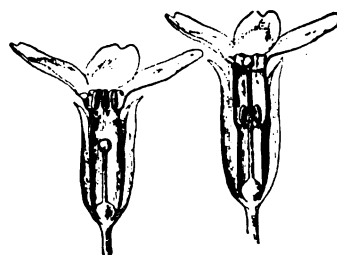
PRIDE OF INDIA: *Melia Azedarach*.

PRIM: *Ligustrum*.

PRIMROSE: *Primula*. Arabian P.: *Arnebia cornuta*. Cape P.: *Streptocarpus*. Common P.: *Primula vulgaris*. English P.: *Primula vulgaris*. Evening P.: *Oenothera*.

PRÍMULA (*Primula veris*, the "first in spring," was an old appellation of one or more of the species). *Primulaceæ*. PRIMROSE. Low plants, for the most part herbaceous, mostly spring-blooming but a few kinds used for winter flowering, producing usually clusters of attractive flowers mostly in white, pink, and rose, but sometimes in red, blue, and yellow.

Perennial (plant sometimes monocarpic or blooming but once), with monopetalous salverform fls. in clusters on scapes that arise from a radical cluster of simple entire or lobed lvs.: corolla-tube usually surpassing the 5-toothed or 5-cleft calyx; corolla with 5 spreading lobes, which are commonly notched or retuse at the end and more or less narrowed at the base; stamens 5, affixed to the corolla-tube; ovary 1-loculed, with many ovules on an axile placenta, and 1 undivided filiform style and a capitate stigma, dehiscent by 5-10 valves: bracts of the floral involucre sometimes lf.-like: the fls. of some species are strongly dimorphic or trimorphic,—the stamens and pistils of different lengths in different fls. of the same species (Fig. 3174). See Darwin's work, "The Different Forms of Flowers on Plants of the Same Species;" this polymorphism is associated with cross-pollination. Often the herbage is covered with a loose meal or farina or powder.—Primulas are natives to the N. Temp. zone, only one being known in the cold parts of S.



3174. Dimorphism in stamens and style of *Polyantha primrose*.

Amer., one in Java, and sparingly in Afr. They are mostly boreal or alpine plants. About a score are native to the colder parts of N. Amer. Twenty-five years ago, Pax (*Monographische Übersicht über die Arten der Gattung Primula*, Leipzig, 1888, and in Engler's *Bot. Jahrbücher*, vol. 10), admitted 145 species. Pax & Knuth, in Engler's *Das Pflanzenreich*, hft. 22 (iv. 237), 1905, describe 208 species and many marked hybrids, and others have been recognized since that time. The number of species now known is upward of 300, with the greatest extension in China (about one-half the species), about 70-75 in the Himalayan region, and the remainder in Japan, N. Amer., Eu., and Eurasia. *P. magellanica* occurs in Patagonia, but is apparently not in cult. The latest horticultural treatment is by S. Mottet, *Monographie du genre primèvre*, Paris, 1915; this work follows the systematic analysis of Pax & Knuth, which also is adopted herewith. The fancier of primules must

also have the proceedings of the Primula Conference held in London in 1913, comprising botanical and horticultural discussions (Journ. Roy. Hort. Soc. 39). The discussion contains a full synonymy of the Chinese and other Asiatic species by Balfour and of European species by MacWatt. For cult. and horticultural descriptions (for England), the reader should consult H. M. Paul, "Handbook of the Hardy Primula," 1911. For evening primrose and Mexican primrose, see *Oenothera*.

Notwithstanding the volume of the recent literature, a comprehensive monograph is still lacking, due to the great extension of the genus by contemporary explorers. Further collecting in the Himalaya-Thibet-China region will undoubtedly discover many more forms. The numbers of new species have made it necessary to extend and to recast the sections as defined by Pax & Knuth; but these have not yet been redefined and keyed at once in a connected treatment for the entire genus, and in a compilation like the present it is necessary to spread the Paxian groups as a tentative expedient, even if species of not very close relationship are brought together; in this compilation, the purpose is not so much to show botanical affinities as to make an effort to enable the consultant to identify given species. Even so, it can not be expected, in a genus so large, so variable, and in which so many of the species are recently discovered and little known, that the groups and keys will be always satisfactory to the student. Much change is likely to take place in the definition or recognition of species in the genus, as the many forms are more closely studied. In the present account, the characterizations of the species have been drawn so far as possible from the recent working authorities. The portraits are cited in the text under the names they bear in the different publications, and the author cannot vouch for the authenticity of all of them. The reference R. H. S., in the citation of portraits, is to the Journal of the Royal Horticultural Society.

The date of introduction, given for some of the recent species, is the year in which they were brought into cultivation in Great Britain. The informal notes on culture, under the different species, apply mostly to Great Britain.

Primulas are cool-climate or cool-season plants, mostly spring-bloomers. Many of them grow at very high altitudes, and depend on very special conditions for their perfect development. Several cultural groups of primulas may be recognized: (1) The alpine and sub-alpine section affords some of the most useful plants for rock and alpine gardens. The relatively little attention given to alpine gardens in this country is the reason for the neglect of these charming spring-flowering plants. In recent years, many species have been added to these outdoor primulas and great interest has arisen in them abroad. (2) The polyanthus class, comprising fully hardy spring-flowering plants, suitable for culture under ordinary garden conditions, and always popular in this country. To the same class belong the true cowslip (*P. veris*) and the oxlip (*P. elatior*), but these are rarely seen in our gardens in their pure form. All are easily propagated by division. (3) Yellow-flowered or purple-flowered verticillate-clustered outdoor species, of the *P. imperialis* and *P. japonica* type, some of which are hardy even in the northern states with some winter protection. (4) The true greenhouse species, represented by the old *P. sinensis* (Chinese primrose), the more recent *P. obconica* and the still more recent *P. malacoides*. These are Chinese species. The colors are of the cyanic series. (5) The auriculas of gardens, developed from *P. Auricula*.

In Great Britain, much interest is now taken in new primulas, and very many species are more or less in cultivation, the larger part of them as fancier's subjects. Not many of them have been tried to any extent in this country, and it is commonly assumed that the

American hot summers are against them. Many of them are easily grown from seed and can be carried over in pots in a frame, if they are not hardy or will not withstand the changeable conditions of the open winter. Some of the species do well in open light, but the larger number of the new kinds probably require protection from sun; the species demand an equable supply of moisture. Some of the species mentioned in this country for outdoor growing are *P. Auricula*, *P. Beesiana*, *P. Bulleyana*, *P. capitata*, *P. cortusoides*, *P. denticulata*, *P. farinosa*, *P. frondosa*, *P. japonica*, *P. marginata*, *P. minima*, *P. pulverulenta*, *P. rosea*, *P. Sieboldii*, *P. sikkimensis*, *P. Veitchii*, aside from the English primroses, oxlips, and cowslips (*P. acaulis*, *P. elatior*, and *P. veris*), and the auriculas. For the cultivation of the auricula, see Vol. I, page 430.

Cultivation of hardy primulas. (E. J. Canning)

The hardy primulas are not so well known in American gardens as they deserve to be, although their culture is gradually on the increase, and new species are occasionally introduced. Perhaps the best known and most commonly cultivated are those which are native to the meadow lands of Great Britain, central and northern Europe. These are the English primrose (*P. acaulis*), the cowslip (*P. veris*), the oxlip (*P. elatior*), and the polyanthus (*P. Polyantha*). They are all simple in their requirements, growing and flowering freely in any good garden soil, and are quite hardy as far north as Massachusetts at least, provided they are not planted in a too exposed or wind-swept position. They are all very attractive when in flower, and they can also be grown in pots and easily forced for flowering in the greenhouse in February and March.

These primulas may be propagated by seeds or division. Seeds may be sown in February in pans or small shallow flats in a mixture of loam, leaf-mold, and sand of about equal proportions, making the surface very fine, pressing the seeds evenly into the soil and covering with about $\frac{1}{4}$ inch of the finely sifted mixture. Place the flats or pans in a warm greenhouse or a temperature of 55° to 60° at night with a rise of 15° by day. In two or three weeks the seedlings should begin to appear. As soon as large enough to handle, they may be pricked out into other flats in a similar soil, and about 2 inches apart each way. By the middle of May they will be good plants, and since they do not flower the first season, they may be planted out in lines in some sheltered part of the garden till September, when they may be lifted and planted where they are wanted to flower in spring. Also those intended for flowering in the greenhouse should be potted at this time. Seeds may also be sown in a coldframe in April or May, scattering them very thinly in shallow drills, watering and keeping free from weeds in the summer, and transferring them in September to the position in the garden where they are to flower in the spring.

Propagating by division is practised when the plants become rather large or to perpetuate some very fine variety. It consists simply in dividing the plant or clump into two or more parts and replanting again. September is the best month to do this.

The cowslip, oxlip, and English primrose are excellent subjects for massing or naturalizing in open woodland, on sheltered banks, or any position where they are not too shaded, and where they can be left undisturbed for several years. They are almost indispensable in gardens where a spring display of flowers is wanted. A light mulching with stable-manure, or in very cold gardens, a few branches of hemlock or pine, is all the winter protection they need.

Other hardy primulas not so well known as the above, but even more beautiful and showy and some of them of larger growth, are species from China and Japan, some of them from high altitudes in the Himalaya

mountains, and others from boreal and mountainous regions of Europe and North America. From Japan, *P. japonica* and *P. Sieboldii* are the best. From China, *P. pulverulenta* and the recently introduced species, *P. Bulleyana* and *P. Beesiana*, are large and showy, producing their bright flowers in whorls, *P. Beesiana* having from five to eight whorls with an average of sixteen flowers in a whorl. From experience and observation, the writer finds that they must have a deep rich moist soil in a sheltered place, with an eastern aspect, or where they are shaded during the warmest part of the day. A low moist nook in a properly constructed rock-garden is an ideal place for them.

The high mountain and northern species, *P. cortusoides*, *P. denticulata* and the variety *cachemiriana*, *P. rosea*, *P. farinosa*, *P. mistassinica*, and *P. Auricula*, require a rich moist soil with an eastern aspect in a rock-garden for their successful culture. It is not so much the cold of the winters as it is the heat and drought of our summers that makes their cultivation difficult.

Most of them flower through the months of May and June. They are all propagated by seeds which may be sown in flats in a cool shaded frame as soon as ripe or about the end of July, wintering the seedlings in a cool greenhouse or frame the first winter, and planting out in the rock-garden in spring; or seeds may be sown in February in a warm greenhouse as recommended for the English primrose, but keeping the seedlings in flats in a shaded frame till September before planting in the rock-garden. A light dressing of decayed stable-manure carefully placed between the plants as winter comes on and a few hemlock or pine branches to protect them from the sun in winter are beneficial.

While this last group of primulas may never become so popular in this country as they are in the cool and moist climate of England, yet, for anyone who can provide the conditions, they are well worth growing.

Commercial culture of florist's primulas. (E. A. White)

Primulas have long been regarded as important by commercial plant-growers. Their compact dwarf habit of growth and their freedom of flower production make them especially desirable. They have never been used extensively as cut-flowers, yet the flower-clusters of some species, such as *P. obconica* and *P. malacoides*, lend themselves well to artistic arrangement and are sold in limited numbers in the larger cities, usually in bunches of twenty-five sprays. *P. Polyantha* also produces sprays of blooms which are particularly attractive in spring when cut and arranged in a somewhat formal manner similar to bunches of trailing arbutus. The species most generally grown under glass for potted plants are *P. obconica*, *P. sinensis*, *P. kewensis*, and *P. malacoides* (fairy primrose); *P. Forbesii* (the baby primrose) is still sometimes grown.

While *P. sinensis* in its varying varieties is still grown as a potted plant to a considerable extent, it is of less importance commercially than are *P. obconica*, *P. kewensis*, *P. malacoides*, and *P. floribunda*. *P. sinensis* var. *stellata* seems more in demand than the type. When taken from the greenhouses to a dwelling-house or a flower-store, the individual flowers of *P. sinensis* soon fade and the plants become unsightly. Retail dealers speak of them as "poor keepers." The most desirable varieties of *P. sinensis* are Crimson King, Pink Beauty, Reading Blue, Orange King, The Czar, The Duchess, Coral-Pink, Princess May, and Royal White. In the stellata group, White Star, Pink Star, Light and Dark Blue Star, and Giant Red Star are most frequently grown. *P. malacoides* and *P. obconica*, the latter in its several varieties, Kermesiana, Fire King, and Giant Red are probably the most important present-day primulas.

Primulas are usually propagated yearly from seed. When very large plants for exhibition purposes are

desired, the plants may be carried over a second year. Young plants are usually more productive of blooms, hence are more desirable. Seeds must be fresh. Primulas may also be propagated from cuttings.

When large plants are desired for Christmas, the seed is sown in January. Later sowings may be made in February and March. Seed-pans should have a layer of broken crock in the bottom for drainage, and a little coarse material is placed above this. The seed-pan is then filled evenly full with a mixture of equal parts of leaf-mold and sand. This is compacted slightly, being careful to have the surface even. The top of the soil should not be over $\frac{1}{8}$ inch below the top of the rim of the pan. If lower than this, the confined atmosphere about the seedlings may cause an attack of the "damping-off" fungus. The seeds are then sown evenly and thinly over the surface and a thin covering of one-half finely sifted leaf-mold and sand, thoroughly mixed, is sprinkled evenly over the top. The seed-pans are then sprinkled with a fine spray, covered with glass, and placed in a partially shaded spot. As soon as the seedlings germinate, the glass should be removed. The germination period in the life of primulas is a critical one, and temperature, light, and moisture require particular attention.

When the seedlings have developed about three leaves, they should be transplanted. Small flats are preferable to pots. The seedlings are spaced about $1\frac{1}{4}$ inches each way. A soil compost of equal parts of leaf-mold and sand is excellent for the first transplanting. When the seedlings have developed about five leaves they should be potted into 2- or $2\frac{1}{4}$ -inch pots. Care should be taken in this first potting and in subsequent repottings not to set the plants too deeply in the soil, as it causes the lower leaves to decay. The crown should be even with the soil. If it is above the soil, the plants will be inclined to topple over as they reach maturity and it may be necessary to stake them. At no time should the young plants be allowed to become pot-bound. Any check in their development during the rapid-growing period prevents the perfection of the plants. They should be repotted several times and the soil made a little richer each time by the addition of well-rotted cow-manure and bone-meal.

About the tenth of June primulas may be put into a frame out-of-doors. A shaded glass sash should be put over them and raised about 2 feet above the frame. This gives excellent air circulation about the plants and makes them strong and stocky. In August the plants are repotted for the last time. Six-inch pots are mostly used. The soil at this time should be considerably heavier and richer than previously. A mixture of three parts leaf-mold, two parts finely chopped sod, one part sand and one part well-rotted cow-manure with a liberal sprinkling of bone-meal makes an excellent soil for primroses. Watering should be carefully attended to in the summer months.

About the middle of September the plants should be brought into the greenhouse and placed in a coolhouse where a night temperature of about 45° can be maintained. This low temperature induces a stocky healthy growth and subsequently large strong flower-spikes. After bringing the plants into the greenhouse, they should become accustomed gradually to full sunlight. After a few weeks in a coolhouse, the temperature may be gradually raised to 50° or even 60°; but the plants are better if grown in a low temperature.

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KEY TO THE SECTIONS OR GROUPS.

- I. Plants of hybrid origin, of many kinds, more or less in cult. I. HYBRIDS, p. 2786.
- II. Plants of specific difference, representing wild or native species of *Primula*.
- A. Young lvs. involute (edges turned inward).
- B. Lvs. mostly thick or coriaceous: fls. umbellate: bracts of involucre usually not lf.-like II. AURICULA, p. 2787
- BB. Lvs. thin or membranaceous: fls. in superimposed whorls or verticels: bracts of involucre leafy. III. FLORIBUNDAE, p. 2791.
- AA. Young lvs. revolute (edges turned backward).
- B. Lvs. lobed and distinctly petioled, the lobes dentate or crenate. IV. SINENSES, p. 2791.
- BB. Lvs. not lobed or only indistinctly so.
- C. Calyx leafy, strongly accrescent (increasing in size) after flowering. V. MONOCARPICAE, p. 2795
- CC. Calyx little or not leafy or accrescent: plant stoloniferous. VI. MINUTISSIMAE, p. 2796
- CCC. Calyx as in CC.: plant not stoloniferous.
- D. Fl. solitary on a bractless scape. VII. OMPHALOGRAMMA, p. 2796
- DD. Fls. usually many (sometimes solitary) on a bracted scape.
- E. Foliage usually pilose or pubescent.
- F. Blossoms distinctly pedicellate (each one on a stalk).
- G. Lf.-texture coriaceous or nearly so, strongly rugose.
- H. Length of lvs. 4 in. or less. VIII. BULLATAE, p. 2796.
- HH. Length of lvs. 4 in. or more. IX. CAROLINELLA, p. 2797.
- GG. Lf.-texture thin or membranaceous, rugose.
- H. Base of lf.-blade cordate; petiole distinct. X. FALLACES, p. 2797.
- HH. Base of lf.-blade usually attenuate into a petiole. XI. VERNALES, p. 2797
- FF. Blossoms sessile or very short-pedicellate.
- G. Bracts of involucre short and broad. XII. SOLDANELLOIDEAE, p. 2799.
- GG. Bracts lanceolate or subulate. XIII. CAPITATAE, p. 2800.
- EE. Foliage usually glabrous or only minutely pubescent.
- F. Bracts of involucre gibbous or saccate at base. XIV. FARINOSAE, p. 2801.
- FF. Bracts not gibbous or saccate.
- G. Base of lf.-blade cordate; petiole distinct: caps. cylindrical.
- H. Corolla funneliform. XV. CORDIFOLIAE, p. 2804.
- HH. Corolla cylindrical. XVI. SREDINSKYA, p. 2804.
- GG. Base of lf.-blade gradually narrowed into petiole: caps. globose.
- * H. Umbel 1-2-fld.: lvs. somewhat coriaceous: plants low, sometimes very small. XVII. TENELLAE, p. 2804.
- HH. Umbel several- to many-fld.: lvs. either petioled or narrowed into a winged base, the midrib very wide: plant mostly low, but scape sometimes long. XVIII. PETIOLARES, p. 2805.
- HHH. Umbel several- to many-fld.: plant tall.
- I. Blossoms pedicellate, in superimposed umbels: lvs. membranaceous or papery, serrulate or denticulate. XIX. CANCRIENIA, p. 2805.
- II. Blossoms very short-pedicelled or nearly sessile, mostly in simple umbels: lvs. usually coriaceous, obtusely denticulate. XX. CALLIANTHEAE, p. 2807.

- ggg. Base of lf-blade narrowed into a winged petiole, the lf-margin entire or denticulate: caps. cylindrical. XXI. NIVALES, p. 2807.
- gggg. Base of lf-blade cuneate or rounded, contracted to petiole, the margins usually coarsely toothed toward apex: caps. cylindrical or ovoid. XXII. MACROCARPÆ, p. 2808.

I. HYBRIDS AND REPUTED HYBRIDS.

Several hybrid primulas have attained more or less prominence in cult. aside from those in the Vernaes group (*P. elatior-veris-acaulis* set), and they are briefly described here; *P. kewensis* is apparently the best known of them in cult. In a genus so vast and abounding in beautiful forms, many good cultural hybrids are to be expected, although the number of artificial ones is surprisingly small considering the number of species and the length of time some of them have been in cult. For an account of Primula hybrids in nature, see Farrer, Journ. Roy. Hort. Soc. 39:112-28; also the monograph by Pax & Knuth.

A. Fls. yellow.

1. *kewensis*, W. Wats. (*P. floribunda* × *P. verticillata*). Fig. 3175. A hybrid that appeared in one of the houses at Royal Botanic Gardens, Kew, in 1897, blooming in 1899: it has some of the mealiness of *P. verticillata* and the general appearance of a robust form of *P. floribunda*: lvs. in rosette, 6-8 in. long and 1½-2 in. wide, obovate-spatulate, tapering to a petiole-like base, margins wavy and dentate: scapes many, 1 ft. high, slender but erect, glabrous, bearing 2-4 whorls of 6-10 bright yellow fragrant fls. on slender pedicels: bracts large, dentate: calyx campanulate, the lobes regular and acute; corolla-tube 1 in. long, the limb ¼ in. across, the lobes nearly circular and notched. G.C. III. 27:195. R.H. 1908:400. Gn. 59, p. 198; 64:10. G.M. 43:232; 51:320. G. 26:99. Gn.M. 15:18. Gn.W. 20:249; 21:214.—A var. *farinosa*, Hort., is listed, the sts. and foliage covered with silvery white powder. *P. kewensis* is a good winter bloomer of long season, and a desirable companion for *P. sinensis* and *P. obconica*; requires the general treatment of *P. obconica*.

AA. Fls. not yellow, in shades of red or purple, sometimes white.

B. Plants of the Auricula section or type.

2. *admontensis*, Guss. Said to be a hybrid between *P. Auricula* and *P. Clusiana*, but probably a *P. Clusiana* form or *P. Clusiana* × *P. minima*: described by Paul as a very dwarf-growing plant, hardly 3 in. high: fls. large, purplish lilac, in June: lvs. fleshy, round-oval, evergreen. Admont, in Steiermark, Austria.—Said to thrive in full sun in limestone soil.

3. *Arctôtis*, Kerner. One of the numerous hybrid progeny of *P. Auricula* and *P. hirsuta* (see *P. pubescens*, No. 20): as a garden plant, said to have acquired some of the characteristics of both parents: fls. lilac-purple or white, in May and June, on scapes 4-5 in. high.—Succeeds in partly shady places in sandy loam; natural hybrid.

4. *Berninæ*, Kerner (*P. hirsuta* × *P. viscosa*). Three to 4 in.: fls. large, rosy purple, on short sts.; April, May.—A natural hybrid.

5. *biflora*, Huter. Natural hybrid of *P. glutinosa* and *P. minima*: fls. in 2's, deep rose-colored, rising scarcely more than 1 in. above the foliage, early.—Requires partial shade and a well-drained position.

6. *Bilëkii*, Hort. A natural form from the Tyrol, probably hybrid of *P. minima* and *P. hirsuta*: very small, resembling *P. minima* but slightly taller, bearing profusely of large pale rose-colored fls.; late spring and early summer.

7. *Böwlesii*, Farr. (*P. pedemontana* × *P. viscosa*). A natural hybrid, usually larger than *P. pedemontana*, the upper face of lvs. densely glandulose, scale longer, pedicels longer and densely glandular, the umbel few-fl. and 1-sided; smaller than *P. viscosa*, the fls. wider, the lvs. and pedicels with more or less rufous glands: intermediate between the parents, with which it was found. Intro. 1911.

8. *discolor*, Leyb. (*P. Pörtz*, Huter). Natural hybrid of *P. Auricula* × *P. anensis*: said by Paul to be "a charming plant for sunny places on the rockery." 3-4 in.: fls. lilac-purple with silvery white eye; April-June.

9. *Fäcchinii*, Schott. Natural hybrid of *P. minima* × *P. spectabilis*: said to inherit the strength and vigor of *P. spectabilis* and the free-flowering qualities of *P. minima*: 3 in.: fls. rosy purple, usually 2 or 3 to each



3175. *Primula kewensis*. (×½)

st.; May, June.—Paul says that it is essentially a rock-plant, succeeding in shady positions as well as in full sun in light sandy soil. G.W. 15, p. 273.

10. *Floerkeana*, Schrad. Natural hybrid, *P. glutinosa* × *P. minima*: an excellent plant, intermediate between the parents: 3 in. or less: fls. bright rose, in heads.—Succeeds best in partly shaded places in rockery, in peaty loam.

11. *Försteri*, Stein. Natural hybrid of *P. hirsuta* × *P. minima*: resemblance closer to *P. minima*, but with 2 or 3 larger fls., which are rosy purple with white throat, carried 3-4 in. above the foliage. Brenner Alps. G.C. III. 52:490.—Prefers loamy soil in partial shade; blooms in early spring and also in autumn.

12. *Goëblüi*, Kerner (*P. Goëblüi*, Hort.). Natural offspring of *P. Auricula* × *P. hirsuta*: 4-5 in.: lvs. stiff and fleshy, in close rosettes: fls. brownish violet;

May-July.—Sunny position in rockery. See *P. pubescens*, No. 20.

13. *Heëri*, Bruegg. Natural hybrid of *P. hirsuta* and *P. integrifolia*: a showy dwarf tufted plant, with loose heads in June of bright purple fls.—Shady place in the rock-garden, in light loam.

14. *Hüteri*, Kerner. Natural offspring of *P. glutinosa* × *P. minima*: very small, scarcely more than 1 in. high: fls. rather large for size of plant, deep violet, borne singly; May, June. Tyrol.—Of good constitution; prefers slightly shaded place.

15. *intermedia*, Hort. Several applications are covered by the name *P. intermedia*: described and illustrated in G. 8:259 as "one of the most beautiful of the members of a very large family, and closely resembles the alpine auriculas, its fls. being purplish crimson, with a conspicuous yellow eye, and produced on stout sts. in crowded clusters that overtop the foliage:" fragrant. April.—The garden plant under the name *P. intermedia* is probably one of the natural hybrids of *P. Clusiana* and *P. minima*.

16. *Këllereri*, Widm. Natural hybrid of *P. hirsuta* and *P. minima*: very dwarf, but sturdy: fls. pale rose-colored, in trusses; May, June. Tyrol.—Slightly shaded positions in a light sandy soil.

17. *Kërneri*, Goebel & Stein. *P. Auricula* × *P. hirsuta*, a natural hybrid (see *P. pubescens*, No. 20): 4-5 in., hairy: fls. rose-lilac, with yellowish white eye; April, May.—Sunny and dry positions in rockery.

18. *Muretiàna*, Moritz. (*P. Mureti*, Charp.). Natural hybrid of *P. integrifolia* and *P. viscosa*; a similar cross is *P. Dinyàna*, Lager, which may be the preferable name for the group: lvs. pale green, in rosettes, stiff and fleshy: scapes 4-5 in.: fls. bright purple, in clusters; April, May.—Lightly shaded places in rockery.

19. *Peyritschii*, Stein. Natural hybrid of *P. Auricula* and *P. hirsuta* (see No. 20): 4-5 in., producing many crimson-purple fls. in large clusters; March-May.—Strongly recommended for partly shaded places in well-drained soil in the rock-garden.

20. *pubescens*, Jacq. Several natural forms of *P. Auricula* × *P. hirsuta* are included under the name *P. pubescens*; here may be referred the variants represented by the names *P. helvetica*, Don, *P. rhætica*, Gaud., *P. Arctotis*, Kerner, *P. Goeblii*, Kerner, *P. Kërneri*, Goebel & Stein, *P. Peyritschii*, Stein, all probably differing in minor characters and garden value. *P. pubescens* is a hardy plant, according to Paul, and easy to grow in both sun and shade, if it has a well-drained place: 3-4 in.: fls. rosy crimson with white eye; May, June. *P. pubescens alba*—*P. hirsuta* var. *nivea* (No. 41), a very free-flowering plant, with large snow-white fls. which make an excellent display against the rosettes of stiffish lvs. Gn. 75, p. 88. G.L. 16:95.

21. *rhætica*, Gaud. One of the *P. pubescens* forms (No. 20), hybrid of *P. Auricula* and *P. hirsuta*: lvs. white-mealy: scape 3 in. above foliage, mealy: fls. large, clustered, brilliant violet-purple; May-July, flowering continuously in a sunny place in the rockery.

22. *salisburgensis*, Floerke. Natural form of *P. glutinosa* × *P. minima*, perhaps not in cult.: lvs. cuneate, strongly 7-9-toothed toward the top, serrate at summit: scape not glutinous: fls. rose-colored.

23. *Stürlii*, Schott. Natural hybrid of *P. minima* and *P. villosa*: dwarf and tufted but vigorous and free-flowering: fls. large, bright rose-purple, borne singly; April-June.—For shaded places in the rock-garden.

24. *venusta*, Host (*P. Jelénke*, Gussm.). Natural hybrid of *P. Auricula* and *P. carniolica*: habit of *P. carniolica*, but the lvs. and calices sometimes more or less white-mealy: vigorous and hardy; 3-4 in., forming large spreading rosettes: fls. fragrant, red to brownish

rose or purple; April-June.—For half-shady places in the rock-garden.

25. *Venzöi*, Huter (*P. adulterina*, *P. cridatensis*, *P. micrantha*, and *P. valmenöna*, Gussm.). Natural hybrid of *P. tyrolensis* and *P. Wulfeniana*: large or small, mostly a strong and free grower with lvs. in rosettes: scapes 3-4 in. above foliage: fls. in loose heads or clusters, large, lilac-purple.—For half-shady places in the rock-garden.

26. *vochinensis*, Gussm. One of the natural forms of *P. minima* × *P. Wulfeniana*: robust, 4-6 in., or much less in the wild: lvs. oblong, usually few-toothed but rarely entire: fls. in trusses, bright red, spring to late summer.—Said by Paul to be serviceable for chalky soils in dry sunny places.

BB. Plants of various sections, probably not of the *Auricula* group or kind.

27. *Aréndsii*, Hort. Arends. Said to be a hybrid between *P. obconica* and *P. megasezifolia*, "in general appearance similar to a glorified *P. obconica*:" fls. rich lilac-pink in color, in many-fl. umbels: lvs. more nearly resembling those of *P. megasezifolia*, the petioles exceedingly hairy.

28. *Briscoei*, Hort. Veitch. (*P. Bulleyana* × *P. japonica*, of garden origin). Habit of *P. japonica*, but with paler lvs. and more crimsoned midrib, the infl. inheriting to some extent the powdery character of *P. Bulleyana*; the scapes and fls. are said also to resemble *P. pulverulenta*; purple-fl. (?).

29. *Fórtunei*, Vatke, is undetermined. The plant in cult. is described and figured in G.C. III. 53:238 as a perennial with coarsely dentate lvs., with very little farina: scapes about 3 in. high, terminating in a loose head of fls. which suggest those of *P. farinosa*: fls. about ½ in. diam., bluish lilac, with primrose-yellow eye. "Flowering early in the year, it is a useful subject for the alpine house, and the blooms last fresh for a considerable period." Fl. Mag., X. 7 (1860). J.H. III. 63:343. Gn. 69, p. 210; 77, p. 182. G. 37:279.—Rare in cult.; at Kew grown recently from stock contributed in 1905 by Col. Beddome. Perhaps hybrid of *P. denticulata* and *P. farinosa*. Said to be suggestive, as it grows, of *P. frondosa*.

30. *Lindsayi*, Hort. Hybrid, parentage not recorded, with deep crimson fls. with purplish yellow eye: "a pretty plant with neat foliage and fls. of a kind of deep crimson and a purplish yellow eye." Named for R. Lindsay, Edinburgh.

31. *Silva-Tarouçana*, Fedde (*P. pulverulenta* × *P. Cockburniana*, a garden hybrid). Known also as *Unique*: foliage much like that of the common primrose, the blade decurrent on the petiole: fls. turkey red, in tiers, the calyx and pedicel white-farinose. A fine garden plant. G.C. III. 41:391.

32. *Sueptitzii*, Gussm. (*P. rosea* var. *grandiflora* × *P. cashmeriana*, a garden hybrid). Fls. light blue, in April, on strong sts., and strong plants: sometimes bloom in autumn: hardy and free-flowering.—Intro. by P. Süptitz, Bad Lauterberg, Germany.

33. *Tewfikiana*, Hort. Vilm. Garden hybrid of which one of the parents is supposed to be *P. Bulleyana*: a vigorous grower, producing infl. 2 ft. high: fls. in several tiers, salmon-rose with yellow eye: fertile.

II. AURICULA.

Fleshy-lvd. or coriaceous-lvd. species from the Alps, Pyrenees, and other high mountains of Eu.: fls. in umbels (rarely varying to nearly or quite single): bracts not foliaceous or leafy.

A. Fls. yellow (much modified in color in cult. forms, particularly in No. 34).

34. *Auricula*, Linn. (*Auricula lutea*, Opiz). AURICULA. See p. 430 and Fig. 440, Vol. I, and also for

cult. Low, with a radical rosette of thick obovate-cuneate glabrous or pubescent mealy lvs. 2 or 3 in. long, which are often crenate on the upper part: scape 1-8 in. high (sometimes nearly or quite wanting), usually exceeding the lvs.: fls. in an umbel, sometimes as many as 20, bright yellow and fragrant or inodorous, short-stalked, subtended by minute oval mealy bracts, the segms. obovate-cuneate and emarginate; stamens dimorphous.—This description represents the wild form as understood by J. G. Baker in B.M. 6837. "It is one of the most widely spread of all the species," Baker writes, "as it extends in a wild state from Dauphine and the Jura on the west through Switzerland to Lombardy, the Tyrol, Hungary, and Transylvania." In cult., the plant has run into fls. of many colors. It is possible that some of these forms are hybrid progeny with related species. Baker writes: "What the relation is of this widely spread wild type to the multiform races of the garden *Auricula* is a subject that still remains to be fully worked out." The cult. forms are of two groups,—those having farina on the lvs. and those without it. Var. *albocincta*, Hort. Lvs. densely farinaceous, white-margined. The wild form of the species is little known in cult. MacWatt writes that "by nature it flourishes best where it is most at home, amongst the limestone rocks of the Alps, the Apennines, and the Carpathians. In the wild state the flowers are comparatively small, but under cultivation the scape often carries a big head of large-sized flowers." Var. *ciliata*, Koch (*P. ciliata*, Moretti. *P. Bálbisii*, Lehm. *P. bellunensis*, Venzo), has lvs. not farinose, cartilaginous-margined, more or less glandular-pilose, the edges densely long-ciliate: fls. scentless. Var. *Obristii*, Beck (*P. Obristii*, Stein. *P. similis*, Stein. *P. Bálbisii*, Beck). Lvs. silvery green, not mealy, more or less glandular-hairy, the margin cartilaginous and ciliate: fls. fragrant, yellow, the calices and pedicels mealy; May-July.—For dry sunny edges or rocks.

35. *Palinuri*, Petag. Rhizome woody and widely spreading: lvs. large, often 8 in. long and 3 in. wide, obovate or oblong, fleshy and pliable, light green, not farinaceous, dentate, narrowed into a petiole which is sometimes elongated: scape surpassing the lvs., farinose above, bearing a many-fld., even to 40-fld., umbel: fls. pedicellate, drooping to one side, the floral bracts leafy and farinose; calyx densely white-farinose, campanulate at top, deeply cut into sharp-pointed lobes; corolla deep yellow, standing well out of the calyx, the lobes emarginate: caps. equaling or exceeding the calyx. S. Italy in the Apennine region. B.M. 3414. G.C. III. 41:18. Gn. 76, p. 227. G.M. 55:381.—A striking species with a cowslip odor, blooming in England in May; it is advised in England to grow it in good loam to which peat and sand have been added; in cold districts it is to be kept under glass, with plenty of light and air, in winter; does not bloom until it has attained good size.

AA. Fls. rose, violet, purple, or bluish.

B. Lvs. entire, coriaceous, cartilaginous-margined: bracts narrow and long: fls. rose-colored.

C. Foliage pellucid-punctate and viscid.

36. *spectabilis*, Tratt. (*Arctia spectabilis*, Link). A low plant (3-4 in.) with stiff, glossy green oblong or rhomb-oblong viscid entire lvs. that have a pronounced cartilaginous margin or edge, acute or subacute, deeply pitted on the upper surface: scape equaling or exceeding the foliage, bearing a 1-7-fld. umbel: bracts linear and acute, usually reddish: fls. mauve-colored; calyx tubular-campanulate, with lanceolate obtuse lobes, minutely glandular; corolla exceeding the calyx, about 1 in. across, widened above, the lobes obcordate. Alps. R.H.S. 39:105.—A showy species, requiring a shady place in light soil in the rock-garden; worthy of attention.

CC. Foliage not pellucid-punctate or viscid, green or glaucous.

37. *glaucescens*, Moretti. A vigorous glabrous species, not farinose: lvs. 1-4 in. long, lightly glaucous and blue, stiff, shining, narrowly oblong or lanceolate, acute, broadly cartilaginous-margined: scape 2-5 in. high, somewhat exceeding the foliage, bearing a 2-6-fld. umbel: bracts leafy, usually reddish, linear: fls. rose, lilac, or purple; calyx tubular, cut to middle or below, the lobes lanceolate or oblong and acute or somewhat obtuse; corolla funnelform, about 1 in. across, with obcordate lobes: caps. oblong, included in calyx. Alps. Gn. 61, p. 360. R.H.S. 39:105. Var. *calycina*, MacWatt (subsp. *calycina*, Pax & Knuth. *P. calycina*, Duby). Stouter: lvs. and calyx large, the latter cut beyond middle with acute lobes: corolla-limb about $\frac{3}{4}$ in. across. G.W. 15, p. 271. G. 36:273. Var. *longobárda*, MacWatt (subsp. *longobárda*, Pax & Knuth. *P. longobárda*, Porta). Smaller: lvs. and calyx small, the latter cut to middle with acute or obtuse lobes: corolla-limb scarcely $\frac{3}{4}$ in. across.

38. *Wulfeniana*, Schott. Spreading tufts: lvs. 1-2 in. long, stiff, lanceolate to oblong and elliptic, not viscous, shining, dark green, margined and minutely glandular: scape about 2 in. high, equaling or surpassing the foliage, bearing 1-3 fls.: bracts linear, usually reddish: fls. rose-colored; calyx tubular, glandular, more or less purplish, with ovate-obtuse lobes; corolla with white throat, the limb funnelform and about 1 in. across, the obcordate lobes deeply emarginate: caps. included in calyx. Alps, chiefly Austrian. Gn. 61, p. 429.—Very early blooming in cult. and not difficult to grow.

39. *Clusiàna*, Tausch. Foliage lighter in color than in No. 38, the lvs. stiffish and somewhat shining, scarcely viscid, ovate or oblong, acute or obtuse, entire and the margin narrowly cartilaginous: scape sometimes 4 in. or more high (usually 6-7 in. under cult.), glandular, 1-6-fld.: bracts lanceolate or linear, more or less purplish: fls. rose-colored or lilac; corolla-lobes bifid rather than emarginate. Austrian Alps. G.W. 15, p. 271. R.H.S. 39:105.—Of easy cult. in a slightly shaded place.

BB. Lvs. serrate or dentate (sometimes only subserrate or, as in No. 40, perhaps entire), coriaceous or fleshy: bracts various: fls. rose-colored, bluish, or violet.

C. Foliage not farinose but reddish glandular-hairy, at least on margin (with a reddish exudate).

D. Glandular-hairy on margins of lvs. only.

40. *pedemontana*, Thomas. Lvs. ovate or oblong-lanceolate, acute or obtuse, dentate or sometimes practically entire, shining, the margin densely glandular red-ciliate, otherwise glabrous or nearly so: scape surpassing the lvs., about 6 in. high, glandular, bearing 1 to many rose-colored or rarely white handsome fls.: bracts ovate and obtuse, scarious: calyx tubular-campanulate, glandulose; corolla minutely reddish glandular, the throat white, limb about 1 in. across, the lobes obcordate. Graian and Cottian Alps. B.M. 5794. Gn. 61, p. 397; 72, p. 166.

DD. Glandular-hairy on both surfaces of lvs.

E. Fls. long-pedicelled (pedicels usually $\frac{1}{4}$ - $\frac{1}{2}$ in. or so in length): scape mostly shorter than the lvs.

41. *hirsuta*, All. Lvs. broadly obovate or rhomboid, varying rarely to somewhat cuneate, obtuse, very viscid, with yellow, orange, or reddish glands, toothed toward the apex or throughout: scape glandular, often shorter than lvs., to about 3 in. high, bearing 1 to many fls. on filiform pedicels: bracts broadly ovate and obtuse, scarious: fls. lilac, rose, or white; calyx broad-campanulate, glandular; corolla-limb 1 in. or less across, with obcordate emarginate lobes: caps. included in calyx. Pyrenees, Alps, Apennines. B.M. 14 (as *P. villosa*); 1922 (as *P. decora*). Gn. 61, p. 359. R.H.S. 39:105.

The species is said to be grown sometimes as *P. viscosa*. Runs into var. *angustata*, Widm., with oblong lvs. gradually narrowed into a petiole, and rose-colored fls.; var. *exscapa*, Pax, scape very short or none, and lvs. nearly sessile; var. *nlvea*, Sims, fls. white. B.M. 1161. Gn. 78, p. 314. G.M. 57:191. The white-flid. plant cult. as *P. nivalis* and as *P. pubescens alba* is this form (see No. 20). In gardens are forms known as vars. *ciliata*, *coccinea*, and *Balfouriana*.

EE. Fls. short-pedicelled (pedicels usually $\frac{1}{4}$ in. or shorter): scape equaling or exceeding the lvs.

F. Shape of lvs. narrow and cuneate.

42. *œnensis*, Thomas (*P. daonensis*, Leyb. *P. cadinensis*, Porta). Lvs. very viscid and bearing large red glands, oblong-cuneate to lanceolate-cuneate, grad-

44. *villôsa*, Jacq. Lvs. strongly viscid and densely covered with red glands, broad-obovate or oblong or oblong-lanceolate, gradually rarely suddenly narrowed to the petiole, obtuse, often dentate from the middle or only at the apex or even more or less subentire: scape red-glandular, about 6 in. high, exceeding the lvs., 1-12-flid.: bracts green or scarious, broadly ovate, obtuse: fls. rose or lilac; calyx glandular, not split to the middle with short triangular acute or obtuse lobes; corolla-tube slightly broadened toward the white throat, the limb $\frac{1}{2}$ -1 in. across with emarginate obcordate lobes. E. Alps. Gn. 61, p. 429. G.W. 6, p. 112. R.H.S. 39:105. Var. *commutata*, Chitt. (*P. commutata*, Schott. *P. villôsa*, subsp. *commutata*, Widm.), from Steiermark, has larger and thinner often oblong and coarsely toothed lvs. Gn. 61, p. 328.



3176. *Primula sinensis*. A young plant, as the flowers are beginning to appear. ($\times \frac{1}{4}$) No. 60.

ually narrowed to a petiole, obtuse or truncate at apex, upper margin serrate or dentate: scape mostly exceeding the lvs., about 3 in. high, with 1-7 fls.: bracts broadly ovate, scarious: fls. rose-colored; calyx densely glandulose, tubular-campanulate, with ovate obtuse lobes; corolla white in throat, the limb $\frac{1}{2}$ - $\frac{3}{4}$ in. across, with emarginate obcordate lobes: caps. about equaling the calyx. Rhetian Alps. R.H.S. 39:105.—Said to be easily raised in partial shade in a variety of soils.

FF. Shape of lvs. oblong to broad-ovate.

43. *apennina*, Widm. Lvs. bearing large, short, yellow at length brown glands, ovate, oblong or lanceolate-cuneate, gradually or suddenly narrowed to the petiole, obtuse, entire or toward the apex slightly denticulate or dentate: scape slightly exceeding to double the length of the lvs., bearing 1-8 fls.: bracts scarious, ovate or rounded: fls. reddish purple; calyx glandular: caps. included in the calyx. Apennines.—Dwarf, blooming freely in April and May, in a shady part of rock-garden; said to prefer limestone soil.

45. *Côttia*, Widm. Lvs. viscid and very densely covered with red glands, obovate or oblong-lanceolate, gradually or rarely suddenly narrowed to the short petiole, obtuse or subacute, denticulate or dentate from the middle, rarely from the base or rarely entire: scape frequently exceeding the lvs., glandular, bearing 2-12 fls.: bracts subscarious, obtuse: fls. rose; calyx glandular, campanulate with triangular obtuse or subobtuse lobes; corolla-tube scarcely broadened toward the glandular white throat, the limb $\frac{3}{4}$ -1 $\frac{1}{4}$ in. across with emarginate obcordate lobes: caps. about equaling or slightly shorter than the calyx. Cottian Alps, 3,200-8,000 ft. altitude. R.H. S. 39:105.

cc. Foliage farinose or not, sometimes glutinous but not red-glandular.

D. Bracts elongated: lvs. coriaceous, truncate at apex.

46. *mînima*, Linn. Lvs. little more than $\frac{1}{2}$ in. long, shiny, firm, almost glabrous, the margin not cartilaginous, cuneate or obtriangular, exceedingly truncate and serrate at the apex, narrowed toward the base:

scape short or very short, shorter or rarely longer than the lvs., 1-2 fld.: bracts 1-2, small: fls. rose or white, when rose-colored usually bearing a white eye; calyx covered with sessile glands, not split to the middle, with obtuse or mucronate lobes; corolla-tube whitish, the throat glandular, limb funnel-shape from the base, finally flat, $\frac{1}{2}$ - $1\frac{1}{4}$ in. across, with bifid, obcordate lobes: caps. included in the calyx. Mountains of S. E. Eu. (Austria and Balkan region), in limestone and granitic regions. Gn. 61, p. 397. G.W. 15, p. 273. R.H.S. 39:113.—A choice little plant of several forms, one of which has fringed corolla-lobes. Plant about 1 in. high.

DD. Bracts elongated: lvs. fleshy.

Z. Scape equaling or exceeding the lvs.

47. *Kitaibeliana*, Schott. Lvs. more or less glandular-pilose, viscid, the glands discolored, subglaucous, intense-smelling, elliptic or oblong-lanceolate, gradually narrowed to the long petiole, acute or obtuse, margin entire or toward the apex wavy-denticulate: scape glandular, shorter than the lvs., bearing 1-2 fls.: bracts herbaceous, linear: fls. rose or lilac, with white throat; calyx glandular, reddish, split almost to the middle, with ovate or oblong, acute or obtuse lobes; corolla-tube white, the limb almost flat, $\frac{3}{4}$ -1 in. across, the throat glandular with emarginate, obcordate lobes: caps. included in the calyx. Mountains of S. E. Eu.—Needs a moist shady place.

48. *integrifolia*, Linn. Lvs. scarcely viscidulous ciliate, upper surface covered with few, small, pellucid glands, green, rather shining, margin not cartilaginous, very entire, elliptic or oblong, almost sessile, obtuse or subacute: scape glandular, reddish, bearing 1-3 fls.: bracts herbaceous, often reddish, linear or lanceolate, obtuse or acute: fls. rose-lilac, rarely white; calyx more or less reddish, glandular, not split to the middle, tubular or tubular-campanulate, with ovate or oblong obtuse lobes; corolla-tube broadened toward the densely glandular, rose-colored throat, the limb broad-funnel-form, $\frac{3}{4}$ -1 in. across, with emarginate lobes: caps. included in the calyx. Pyrenees and Alps. G.C. III. 52:258. R.H.S. 39:112.

EE. Scape very short, less than the lvs.

49. *tyrolensis*, Schott. Lvs. viscid, densely covered with hyaline glands, intense green, somewhat shiny, slightly scented, rounded or broad-obovate, suddenly narrowed to the very short petiole, apex rounded, minutely denticulate or almost subentire: scape glandular, more or less exceeding the lvs., bearing 1-2 fls.: bracts herbaceous, linear or lanceolate: fls. rose or rose-lilac; calyx glandular, split to the middle, campanulate, with ovate obtuse lobes; corolla-tube broadened at the glandular white throat, the limb broad-funnel-form, $\frac{1}{2}$ -1 in. across, with emarginate, obcordate lobes: caps. included in the calyx. Mountains of S. Cent. Eu. (Dolomites). R.H.S. 39:112.

50. *Allioni*, Loisel. Lvs. strongly viscid, densely clothed with discolored glands, rather thick, gray-green, slightly scented, not cartilaginous margined, rounded or oblong or oblong-cuneate, gradually narrowed to the shorter or longer petiole, obtuse, entire, or denticulate: scape almost none, bearing 1-7 fls.: bracts scarious, ovate obtuse: fls. rose; calyx glandular, split to the middle with ovate obtuse or acute lobes; corolla-tube paler pink than the limb, the throat glandular, white or yellowish white, the limb $\frac{1}{2}$ - $\frac{3}{4}$ in. across, with the lobes emarginate: caps. included in or equal to the calyx. Maritime Alps, both in sun "and in shallow sunless caves where neither sun nor rain reaches it." G.C. III. 53:85. R.H.S. 39:112.—Said to be difficult to grow in the open, but thrives in perpendicular position in rock-garden where well protected from sun and rain; may also be grown in a pot plunged in a frame.

DD. Bracts broad but short: fls. violet or rose.

51. *marginata*, Curt. Plant 3-4 in. high: lvs. farinose, not cartilaginous margined, the surface not farinose, punctate with short glands, oblong or obovate, obtuse, narrowed gradually to a short petiole, regularly dentate-serrate: scape usually exceeding the lvs., bearing 2-20 fls.: bracts with the pedicels farinose, broad-ovate. H.-like, short: fls. blue-lilac; calyx more or less farinose, campanulate, purplish, split almost to the middle, with the lobes triangular; corolla-tube many times exceeding the calyx, gradually broadened upward, the limb broad-funnel-form, rarely flat, $\frac{3}{4}$ -1 in. across, with emarginate lobes: caps. equaling or exceeding the calyx. Maritime and Cottian Alps. B.M. 191. Gn. 61, p. 398; 63, p. 261; 71, p. 179. G.W. 15, p. 271. R.H.S. 39:104.—Should not be grown vertically. Natively it hangs from crevices in the rocks; it is recommended to grow it in an elevated place in the rock-garden where it may droop.

52. *carnifolia*, Jacq. Entirely devoid of farina: lvs. glabrous or only the margin sparsely glandular-pilose, shiny, bright green, margin cartilaginous, obovate or oblong, narrowed to a short or long petiole, obtuse or subacute, entire or slightly wavy, very rarely remotely somewhat denticulate: scape much exceeding the lvs., sometimes 8 in. long, bearing a many-fld. umbel: bracts broad-ovate, obtuse or acute: fls. rose, at length lilac, white-eyed; calyx split to the middle, campanulate with acute or subobtuse lobes; corolla-tube gradually broadened to a farinose throat, the limb $\frac{1}{2}$ -1 in. across, broad-funnel-form with emarginate, obcordate lobes: caps. equaling or frequently exceeding the calyx. Alps, Idrian district, Austria, near Trieste. Gn. 61, p. 327. R.H.S. 39:104.—The plant is recommended to "be grown in turf to which has been added a little leaf-mold, in positions where it does not get full sun."

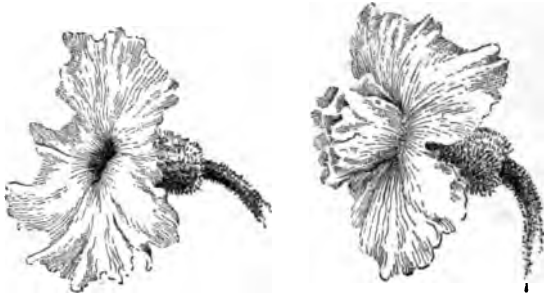
53. *viscosa*, All. (*P. latifolia*, Lapeyr.). Not farinose: lvs. fairly densely clothed with short discolored glands, intensely rank-smelling, yellowish green, rather soft, often more or less curved, the margin not at all cartilaginous, oval or oblong-cuneate or lanceolate-cuneate, obtuse or acute, gradually narrowed or contracted to a petiole more or less equaling the blade, dentate, wavy-dentate or entire: scape glandular, exceeding the lvs., bearing a several- to many-fld. umbel: bracts broad-ovate: fls. 1-sided, nodding, fragrant, violet or red-violet; calyx glandular, or even sparingly farinose, narrowly campanulate, split to the middle with the lobes acute or subacute; corolla-tube gradually broadened from the cylindrical base, the throat sparingly farinose, the limb funnel-form almost $\frac{1}{2}$ in. across with emarginate lobes: caps. more or less exceeding the calyx. Mountains of S. Eu., in several forms. Gn. 61, p. 430; 69, p. 186; 73: 572. G.W. 15, p. 272. H.F. 1:242. R.H.S. 39:104. Forma *cynoglossifolia*, Widm., has lvs. smaller and oval or oblong, entire or only lightly toothed: umbel many-fld. R.H.S. 39:104.—The *P. viscosa* of commerce, according to MacWatt, is chiefly varieties of *P. hirsuta*.

DDDD. Bracts broad and leafy: fls. bluish violet

54. *glutinosa*, Wulf. Deciduous: 3-4 in.: lvs. glandular-viscid, rather stiff, somewhat shining, punctate above, the margin toward the apex subcartilaginous, lanceolate-cuneate or oblong-lanceolate, gradually narrowed to the short-petiole, obtuse, denticulate from the middle, rarely subentire: scape exceeding the lvs., bearing a little head of 1-6 fls.: bracts broad, imbricate, frequently brownish purple, broadly ovate, obtuse: fls. fragrant, intense blue finally violet, rarely white; calyx glandular, not split to the middle, with ovate obtuse lobes; corolla-limb $\frac{1}{2}$ - $\frac{3}{4}$ in. across, funnel-form, with divaricate bifid lobes: caps. slightly shorter than the calyx. Tyrolean and Cent. Alps. Gn. 61, p. 359.—

Said to be difficult to flower under cult., but blooms freely in marshy places where it grows wild; it has the color of a blue gentian.

55. *dedrum*, Velen. Plant 8-10 in. high: lvs. provided with sessile glands, subcoriaceous, stiff, margin cartilaginous, punctate above, oblong or lanceolate, very entire, acute, gradually or scarcely narrowed toward the base: scape viscid, obscurely colored



3177. Single and semi-double flowers of *Primula sinensis*. (X1)

upward, exceeding the lvs., bearing a somewhat nodding, 1-sided umbel of 5-10 fls.: bracts oblong-linear: fls. intense purple-violet; calyx viscid, dark green, split to the middle, with narrowly triangular acute lobes; corolla gradually broadened toward the glandular throat, the limb funnelform, about $\frac{1}{2}$ in. across, with slightly emarginate lobes: caps. included. Bulgaria. B.M. 8124. C. III. 37:98. R.H.S. 39:113. F.S.R. 2, p. 239.—Said to be difficult to grow, but thrives in a rock-garden if well drained.

III. FLORIBUNDÆ.

Thin-lvd. verticillate species, with leafy involucral bracts, from S. W. Asia and Afr.

A. Plant not farinose: calyx very deeply cut.

56. *floribunda*, Wall. BUTTERCUP PRIMROSE. Plant glandular-pubescent, 5-8 in.: lvs. elliptic or ovate, acute or obtuse, membranaceous, narrowed to a broad petiole which is shorter than the blade, irregularly dentate: scape bearing 3-5 many-fld., superimposed umbels which are distant from each other: bracts sessile, lf.-like, ovate or lanceolate, acute, denticulate: fls. golden yellow, fragrant; calyx split below the middle, broadly campanulate with acute lobes which are reflexed after flowering; corolla-tube slender with obcordate, rounded or slightly emarginate lobes: caps. ovate, smooth. Himalayas. B.M. 6712. G.C. II. 19:113; III. 27:195. Gn. 41:580; 61, p. 270. R.H. 1895, pp. 400, 401. Gt. 45:1424; 47, p. 221. Gn.W. 5:453. Var. *grandiflora*, Hort., is offered. Var. *Isabellina*, Hort., free-flowering, with sulfur-yellow bloom.—*P. floribunda* makes a good pot-plant for winter bloom, smaller and more compact than *P. kewensis*. It is grown the same as *P. kewensis* and *P. obconica*.

AA. Plant often farinose: calyx not cut to base.

57. *verticillata*, Forsk. Not glandular, very glabrous, scarcely farinose, 8-10 in. high: lvs. membranaceous, lanceolate or ovate-lanceolate, not farinose, acute or acuminate, irregularly and acutely serrulate, narrowed to a short broad-winged petiole: scape bearing several many-fld. superimposed umbels, farinose below the umbels: bracts 1-nerved; the lower lanceolate or lanceolate-linear, acuminate, sharp-serrulate, longer than the pedicels; the upper smaller, narrow, entire, shorter than the pedicels: fls. yellow, fragrant; calyx deeply parted, campanulate, with linear entire lobes; corolla glabrous, the tube slender, cylindrical, the limb $\frac{3}{4}$ in. across, with obcordate, slightly emarginate lobes: caps. globose, glabrous. S. Arabia. Gn.W. 24:398.—

Tender in England except in sheltered places in the milder parts; requires partial shade and a light soil.

58. *sinensis*, Hochst. (*P. verticillata* var. *sinensis*, Hook. f. *P. Courtii*, Hort. Veitch). Not glandular, bald, or farinose: lvs. membranaceous, ovate-elliptic, acute, irregularly and sharply serrate, narrowed to a short broad-winged petiole: scape bearing several many-fld. superimposed umbels: bracts 1-3-nerved; the inferior lanceolate or ovate, acuminate, sharp-serrate, longer than the pedicels; the upper smaller, subentire, shorter than the pedicels: fls. yellow; calyx deeply parted, campanulate, with triangular-lanceolate, entire lobes; corolla-tube slender, cylindrical; the limb about 1 in. across with broad-ovate, slightly emarginate lobes: caps. globose, included. Abyssinia. B.M. 6042.

59. *Boveana*, Decne. (*P. verticillata* var. *Boveana*, Mast.). Not glandular, more or less farinose or glabrous: lvs. membranaceous, rhomboid or spatulate, acute or acuminate, irregularly serrate or even somewhat incise-lobed, narrowed to a winged petiole which is shorter than the blade: scape bearing several many-fld. superimposed umbels: bracts (at least the lower) sessile, lf.-like, 3-nerved, rhombic-ovate, acuminate, sharp-serrate, exceeding the pedicels; the upper smaller: fls. yellow; calyx campanulate with triangular-lanceolate, acuminate, denticulate lobes; corolla glabrous, tube slender, cylindrical, the limb more or less than $\frac{1}{2}$ in. across with broad-ovate scarcely emarginate lobes: caps. globose. Sinai. B.M. 2842 (as *P. verticillata*).

IV. SINENSES.

Plants of various habit, with lobed distinctly petioled lvs., the lobes dentate or crenate. Himalaya-Chinese region.

A. Calyx prominently inflated, truncate, or squared at the base.

60. *sinensis*, Lindl. (*P. chinensis*, Hort. *P. Mandarina*, Hoffmg. *P. prænites*, Ker. *P. semperflorans*, Lois.). CHINESE PRIMROSE. Figs. 3176, 3177. Trunk short and woody, but as known in gardens the plant is practically stemless, the ample foliage and the strong short scapes arising directly from the surface of the ground or very near it: whole plant soft-hairy: lvs. rotundate, soft, and usually limp, several-lobed and



3178. Wild form of *Primula sinensis*, after one year's cultivation from seed collected in China.

the lobes unequally incise-dentate, long-petioled: scapes erect, exceeding the lvs., bearing 2-3 superimposed umbels: fls. now of many colors, several to many in an umbel, large and showy, salverform, the segms. obcordate; calyx inflated; corolla-limb about $1\frac{1}{4}$ in. across, spread out, the lobes broad-cordate, emarginate: caps. glabrous. China. Winter bloomer, as grown in



3179. Wild form of *Primula sinensis*, as it grows at Ichang, China.

greenhouses. B.M. 2564. L.B.C. 10:916, 20:1926. B.R. 539. F.S. 22:2334-7. I.H. 32:551; 35:42. Gn. 51:468 and p. 469. G.C. III. 25:181, 203, 205. Gng. 2:91. A.F. 8:623, 625, 671. F.R. 4:29.—The Chinese primrose is variable under cult. There are double-fl. forms of various shapes and colors and of various degrees of doubling. For pictures of various double and half-double forms, see R.H. 1867:250, 330. F.S. 20:2145. I.H. 31:512; 35:42; 38:126. J.H. III. 44:515. The normal form of this primrose has a somewhat flat-topped fl.-cluster, but there are forms with pyramidal and elongated clusters. *Primula sinensis* was intro. into England from Chinese gardens in 1820, but it was not until 1879 that the original wild form was known to botanists. For accounts and pictures of this wild primrose as grown in English gardens, see essay by Sutton in Journ. Royal Hort. Soc. 13:99 (1891). G.C. III. 5:117; 8:564; 9:209; 31:270 (reproduced, less than half in Fig. 3179); 11:13 and 31:271 showing the plant after one year of cult. and reduced in Fig. 3178 (figure reproduced in A.G. 13:245). Gn. 49:214. B.M. 7559. G.C. III. 45:148; 55:131. Gn. 62, p. 307. R.H.S. 39:128. Dr. Augustine Henry, who has collected the wild plant at Ichang, in China, writes in Gardeners' Chronicle that "The habitat and mode of growth is remarkably different from what we find in the cultivated forms. The wild plant grows on the ledges of rocky cliffs of limestone, in spots where there is no soil, and practically no moisture, exposed to the sun, and living amidst the decaying remains of former generations of the plants. These ledges of *Primula* are often continuous for hundreds of feet, and in December and January, when the flowers appear, present a scene of great beauty. The scent of the leaves is very strong, and can be perceived at once on entering any of the ravines where the ledges occur. The flowers are pinkish, with a yellow ring around the neck of the corolla."

The general improvement of *P. sinensis* has taken place without hybridity with other species. There are now crested or fringed forms (var. *ambriata*, Hort.), and those with a frill or extra corolla projecting from the throat (Fig. 3177). Gt. 43:1402; 45:1432; 46, p. 192. G.Z. 31:217. H.F. II. 2:228. G.C. III. 27:141. J.H. III. 62:31. The lvs. are variable in shape and depth of lobing. Some forms have crisped lvs. (var. *filicifolia*, Hort.). G.Z. 12:2. Var. *stellata*, Hort. (*P. stellata*, Hort.), Fig. 3180, is a form with handsome star-like long-stemmed fls. in successive whorls or tiers in a long open cluster, in pink, blue, red, and white; now a popular conservatory and florist's form, prized for its taller and freer habit and smaller more numerous fls. Gn. 53, p. 229; 57, p. 52; 59, p. 252 (bench). G. 20:632; 26:88. G.C. III. 45:149. R.B. 36, p. 268. Gt. 64, p. 91. A.F. 17:7; 18:42. F.E. 19:339. A.G. 18:201; 20:384, 385. A.F. 12:605. Gng. 5:167.

AA. Calyx produced into a horn.

61. *pyncoloba*, Bur. & Franch. Plant woolly: lvs. petioled, broadly ovate-cordate, the apex subobtusely lobulate, the lobes unequally denticulate: scape shorter or longer than the lvs., bearing 5-12 fls.: bracts large, lanceolate, reticulate-nerved: corolla-tube cylindrical, the lobes small, erect, obovate emarginate and apparently subincised. Cent. China. Intro. 1906. B.M. 8612. R.H.S. 39:148.—Of this plant Balfour writes: "From a group of petiolate hairy leaves with broad heart-shaped lamina, so common in plants of its alliance, there arises a short scape bearing a close cluster of flowers in which the calyx has enlarged as a long creamy white membranous horn with wide mouth, from the edge of which extend the spike-like sepaline segments. Closing, as it were, the mouth of the horn is seen the small dark red limb of the corolla. There is nothing like it elsewhere in *Primula*. The species is easily grown if protected from overhead moisture when resting, and it spreads rapidly in the soil by root buds which provide a ready means of propagation." He makes for it the Section *Pyncoloba*.

AAA. Calyx little or not at all inflated, narrowed at the base.

B. Shape of calyx goblet-like, after flowering becoming larger.

c. Lobes of calyx entire, acute.

62. *Siëboldii*, Morr. (*P. cortusoides* var. *amëna*, Lindl., var. *grandiflora*, Lem., and var. *Siëboldii*, Hort. *P. patens*, Turcz. *P. amëna*, Hort.). Fig. 3181. Pubescent all over except the corolla: lvs. petioled, ovate-oblong, base cordate, lobed, the lobes numerous, unequally dentate; the petiole longer than the blade: scape exceeding the lvs., bearing a simple many-fl. umbel: fls. white, rose, or purple; calyx funnelliform, with narrowly triangular-lanceolate acute lobes which are lf.-like and glabrous; corolla-lobes broad and emarginate. Japan. B.M. 5528. I.H. 16:599. Gn. 29, p. 382; 35, p. 335; 36:318; 72, p. 327. G.M. 51:911. G. 9:454; 19:175. G.L. 17:365. C.L.A. 23, No. 5, 53. R.H.S. 39:176. Gng. 8:241, 242. R.H. 1892:300.—Looks like a large and robust form of *P. cortusoides*, with fls. $1\frac{1}{2}$ to nearly 2 in. across, the throat usually striped and the limb in various colors. The fls. are two to three times larger than those of *P. cortusoides*. In some forms the fls. are fringed. Blooms in late spring. Hardy N. Several named forms are mentioned in gardening literature, as var. *clarkiaeflora* (G. 37:109), var. *grandiflora*, and others.

63. *obconica*, Hance (*P. poculiformis*, Hook.). Fig. 3182, and Plate XCII. Slender, with loose-hairy lvs. (the sharp hairs often irritating-poisonous): lvs. all radical, ovate-oblong or round-oblong, base more or less cordate, long-petioled, scallop-toothed and very finely serrate: scapes many, 4-10 in. tall, exceeding the lvs.: bracts small, linear, and unequal: fls. small, lilac or light purple, several to many in umbels, on long-spread-

ing or somewhat drooping pedicels, the segms. obcordate; calyx wide open and shallow-toothed. China. B.M. 6582. Gn. 26:206 and p. 206; 29, p. 241; 51, p. 317; 60, p. 416; 61, p. 271; 72, pp. 190, 255; 77, p. 630. G.C. III. 9:401 (house); 35:245; 40:208; 47:28. G.M. 44:51. Gn.M. 2:228. G. 7:889; 20:33; 28:128, 129; 32:321. C.L.A. 2:233. R.H.S. 39:144. Gt. 43, p. 138. F.R. 1:941.—Of late years this species has become a popular winter-blooming pot-plant. The fls. are nearly or quite an inch across in well-grown specimens. There is a var. *grandiflora*, Hort., with fls. nearly or quite 1½ in. across. Gn. 51:316; 74, p. 200. J.H. III. 60:196. G.W. 3, p. 109. R.H. 1892, p. 114. Gt. 46, p. 193. S.H. 2, p. 52. A.F. 13:1063; 18:43. Gn. 6:245. Some of the large-fl. forms have somewhat lacerated or fringed petals (var. *fimbriata*, Hort.); var. *rosea*, Hort., has rose-colored fls.; var. *semi-plena*, Hort., has partially doubled fls. (G.M. 46:206); var. *superba*, Hort., is a large-fl. race in different colors. (R.H. 1906:448); var. *undulata*, Hort., has crisped or undulate fls. (R.H. 1914:300).—Intro. 1880. For history, see Hill, Journ. Genetics, Vol. 2 (1912). *P. obconica* is very easily grown. Prop. by seed. Persons liable to poisoning by the hairs of *P. obconica* should rinse the hands or exposed parts in alcohol, then wash with soap and water.

A number of very recent species closely allied to *P. obconica* are likely to find their way into cult. and perhaps to extend the usefulness and range of this type of primula. Some of these species are: *P. ambita*, Balf. f., a glabrous type from a dry site, with a remarkable involucre; *P. barbicalyx*, C. H. Wright, hairy all over and with a bearded calyx, the lvs. somewhat elongated and with rounded lobes; *P. oreodoxa*, Franch., in which the characters of *P. barbicalyx* are more emphasized (the plant cult. under this name is said to be *P. saxatilis*); *P. begoniiformis*, Petitm., smaller than *P. obconica* and less hairy; *P. parva*, Balf. f., very dwarf, xeromorphous; *P. Vilmoriniana*, Petitm., very hairy, lvs. 2-3 times usual size, scapes short, fls. minute; *P. Petitmengnii*, Bonati, a grotto plant, lvs. large, membranous, and delicate, scapes very short.

64. *sinolisteri*, Balf. f. A recent species of the *P. obconica* type that promises to be of much horticultural value, since it does not have the irritant hairs, is a free grower, forms compact masses of foliage, and produces many trusses of white sometimes lilac fls.: lvs. acutely lobed. Yunnan, China. R.H.S. 39:145.—Said to have been distributed as *P. Listeri*.

cc. *Lobes of calyx entire, obtuse.*

65. *Listeri*, King (*P. obconica* vars. *rotundifolia* and *glabrescens*, Franch.). Lvs. petioled, glabrescent or glabrous, membranaceous, opaque, reniform-orbicular from a cordate base, sinuate-dentate, the lobes irregularly few-toothed or subentire, acute; the petioles slender, manifestly longer than the blade, very short-pubescent, glabrescent: scape much shorter than the lvs., glabrescent, 3-5-fl.: bracts small, linear: fls. rose; calyx almost glabrous, broad-campanulate, with broad-semiorbicular, obtuse or scarcely mucronulate lobes; corolla-tube almost ½ in. long, the lobes obovate, bilobed, at other times entire or denticulate. Himalayas; usually credited to China, but the oriental forms are probably distinct. G.C. III. 53:271.

ccc. *Lobes of calyx denticulate.*

66. *malvacea*, Franch. (*P. langkongensis*, Forr.). Whole plant fairly densely short-pubescent: lvs. glabrescent, bright green, open-cordate at the base, rotundate or very broadly ovate, coarsely crenate, the crenatures denticulate; the petioles longer than the blades: scape thick, exceeding the lvs., bearing 2-3 superposed umbels which are slightly separated from each other: bracts, those below the lowest umbel, lf-like, large, ovate-lanceolate: fls. reddish; calyx pubes-

cent, at the same time clothed with melliferous glands intermixed, cup-shaped, with the lobes frequently denticulate; corolla-limb about ¼ in. across, distinctly annulate at the throat, with obovate, 2-lobed lobes: caps. small, globose, not exceeding the calyx-tube. China. Intro. 1908. R.H.S. 39:149.

67. *blattariformis*, Franch. Whole plant covered with short papilliform hairs: lvs. ovate or obovate, from a rotund or shortly attenuate base, coarsely crenate, the crenatures denticulate; the petioles shorter than the blades: scape erect, much exceeding the lvs., bearing a raceme 8-12 in. long; the pedicels short: bracts equaling the calyx: fls. lilac; calyx broad-campanulate, with acute dentate lobes; corolla-tube puberulent outside, the limb ¼-½ in. across, broadly obcordate, acute: caps. subglobose, small, included in the calyx. China. —"A first glance at the plant suggests *Verbascum*."—Balfour.

BB. *Shape of calyx more or less tubular, little if any enlarging after flowering (perhaps exception in No. 80).*

c. *Stamens affixed in base of corolla-tube.*

68. *heucherifolia*, Franch. (*P. Gagnepainii*, Petitm.). Lvs. petiolate, deeply and narrowly cordate, rotundate, 7-9-lobed to a depth of scarcely one-fourth the diam., sparsely pilose, the lobes ovate-deltoid, unequally dentate; the petiole villous with red hairs: scape much exceeding the lvs., when mature short-pulverulent as well as short-pilose, bearing 3-4 fls.: bracts short, linear-lanceolate, pulverulent: fls. purplish; calyx narrowly



3180. *Primula stellata* of florists, a form of *P. sinensis*, prized for its small well-formed slender-stalked flowers that stand well above the foliage. (X ¼)

campanulate-tubular, with lanceolate acute lobes; corolla-tube cylindrical, the limb concave, about ¼ in. across, with shortly bilobed lobes. Thibet and China. G.C. III. 50:102.

cc. *Stamens affixed in the tube or at the throat of corolla.*

d. *Lvs. paper-like, suborbicular, glaucous beneath.*

69. *chartacea*, Franch. Lvs. long-petiolate, chartaceous, glabrous, ovate-suborbicular, base slightly cordate, obscurely crenate-dentate, glaucous above, pin-

nately somewhat 7-nerved, both surfaces densely finely rusty-punctate: scapes frequently several, 2-3-fld.; the pedicels very slender-puberulent: fls. rose-lilac; calyx urn-shaped, 5-cleft to the middle, the lobes oblong, obtuse, strewn especially at the margin with resinous red dots; corolla salver-shaped, the lobes ovate, 2-cleft: caps. spherical, not exceeding the calyx-tube. Cent. China.

DD. *Lvs. membranaceous or thin, oblong in general outline, doubly crenate and often somewhat lobed.*

70. *cortusoides*, Linn. Lvs. in a rosette on the ground, rather large and soft, loose-hairy (at least on the midrib and petioles), ovate-oblong or cordate-oblong, irregularly many-notched: scapes few to several, 6-12 in. tall, much exceeding the lvs., very straight, hairy: bracts linear: fls. rose-colored, about 1 in. across, short-pedicelled, in a loose many-fld. umbel, the segms. obovate and deeply notched or even lobed. W. Siberia. B.M. 399. Gn. 29, p. 382; 62, p. 217. G.M. 43:247.—A handsome hardy species, blooming in May in the northern states, and represented by garden forms; known sometimes as "bear's-ear primrose," from the large radical lvs. G. 2:207 (var. *amena*); J.H. III. 44:277 (var. *grandiflora lilacina*). It is a question, however, whether *P. cortusoides* is now much known in cult., the plants grown under this name being perhaps *P. Sieboldii* and *P. saxatilis*. It is recognized, according to Balfour, by the short pedicels of the fls.

71. *saxatilis*, Komar. Fig. 3183. Plant pubescent: lvs. oblong or broadly oblong-ovate from a cordate or subcordate base, incise-frequently slightly curled-incise-lobed, the lobes sometimes subentire, sometimes crisped or dentate; the petioles frequently exceeding the blades: scape exceeding the lvs., pubescent below, subglabrous above, bearing 1-10 fls.: bracts linear: fls. rose-violet; calyx ovate-cylindrical or narrowly campanulate,



3181. *Primula Sieboldii*. ($\times \frac{1}{4}$)

prominently nerved, with deltoid acute very shortly puberulent lobes; corolla tubular, the limb up to $\frac{3}{4}$ in. across, with emarginate lobes: caps. oblong, included, very glabrous. E. Siberia. R.H.S. 39:173.—Said to be cult. under the name of *P. oreodoxa*. Pedicels much exceeding the bracts.

DDD. *Lvs. membranaceous, rounded or deltoid in general outline, lobed.*

E. *Foliage bullate or blistered.*

72. *violodora*, Dunn. Plant pubescent: lvs. reniform or orbicular, frequently bullate, base cordate, lobed, the lobes bicrenate; the petiole longer than the blade, covered with violet hairs: scape 8-12 in. high, bearing 2-3 superposed umbels, rarely only 1: bracts small: fls. with the odor of violets, rose-lilac; calyx subglabrous, green, narrowed at the base, with very acute strongly nerved lobes; corolla-tube cylindrical, the mouth yellow, the limb up to $\frac{3}{4}$ in. across, with obcordate lobes. Cent. China.

EE. *Foliage not bullate or blistered.*

F. *Lobes of lvs. obtuse (the lobes sometimes with more or less acute large teeth).*

73. *mollis*, Nutt. Plant softly hirsute-pubescent, 1 ft.: lvs. deeply cordate at the base, the sinus closed, cordate in general outline, sinuate-lobed, crenulate-denticulate, softly pubescent; the petiole densely pubescent, equaling or exceeding the blade: scape pubescent, 8-10 in., after flowering growing to as much as 16 in. high, much exceeding the lvs., bearing 3-5 many-fld. superposed umbels: bracts lanceolate, the upper narrower: fls. bright rose; calyx intense red, soft-hirsute, tube turbinate, with spreading acute lobes; corolla-limb more or less oblique, $\frac{1}{4}$ - $\frac{3}{4}$ in. across, with obovate emarginate lobes. E. Himalayas. B.M. 4798. F.S. 12:1230. Gn. 76, p. 424. G.W. 13, p. 123. R.H.S. 39:184.—May and June to July, requiring a moist or boggy place.

74. *sinomollis*, Balf. f. Lvs. gray-hairy, rounded, petiolate, very shallowly rounded-lobed or scalloped: scapes long, bearing superposed whorls of red fls.: calyx cup-shaped to campanulate, ribbed, with straight erect lobes. Yunnan, China. Intro. 1913. R.H.S. 39:148.

75. *septemloba*, Franch. Whole plant scattered with soft white hairs: lvs. up to $3\frac{1}{2}$ in. diam., in outline orbicular, deeply cordate, sparsely pilose, 7-lobed, the lobes one-third the depth of the lf.-diam., broadly ovate or triangular, obtuse but sometimes with more or less acute large teeth, denticulate; the petioles somewhat hairy, much exceeding the blade: scape up to 12 in. high, slender, clothed with spreading hairs, bearing a small cluster of fls.: bracts linear-lanceolate, obtuse: fls. reddish purple, semi-pendulous and somewhat fragrant; calyx glabrous, tubular-campanulate with lanceolate acute lobes; corolla-limb about $\frac{1}{2}$ in. across, concave, with obovate emarginate lobes. Cent. China. Intro. 1908. G.C. III. 58:297. R.H.S. 39:145.

76. *oculata*, Duthie. Allied to *P. septemloba*, with geranium-like lvs. and red-purple drooping fls. which are darker in color than those of the related Chinese species. W. China. Intro. 1904.

FF. *Lobes of lvs. acute.*

77. *Kaufmanniana*, Regel. Lvs. pubescent, becoming glabrescent, petiolate, about 2 in. long and broad,



3182. *Primula obconica*. ($\times \frac{1}{4}$)

orbicular in outline, cordate or subtruncate at base, the many lobes oval and few-toothed, the petiole exceeding the blade: scape 6-8 in. tall, over-topping the lvs., soft-pubescent below and glabrescent above, carrying a many-fld. umbel: bracts lanceolate, acute, exceeding the pedicels: fls. rose-purple; calyx glabrous or nearly so, the lobes erect and acute; corolla exceeding calyx, the limb more than $\frac{1}{2}$ in. across, the obcordate lobes emarginate. Cent. Asia.

78. *polynetra*, Franch. Lvs. petiolate, 1-2½ in. long, broadly deltoid or suborbicular, about 11-lobed, the lobes broadly ovate and dentate or crenate, the petiole very long: scape 4-16 in. tall, much overtopping the lvs., pubescent, the umbel solitary or 2 or 3 superposed: bracts lanceolate, shorter than the villose pedicels: fls. purplish or violet(?); calyx ribbed, long-tubular, pilose, the lobes lanceolate-acute; corolla-tube cylindrical, twice exceeding the calyx, the limb about ½ in. across, lobes bifid. Cent. China.—*P. Veitchii* and *P. lichiangensis* may be minor forms of this.

79. *Veitchii*, Duthie. Lvs. petioled, when young subrugose, about as broad as long, lobed, the lobes dentate, green and pubescent above, dense-white floccose-tomentose beneath; the petiole equaling the blade: scape exceeding the lvs., 10-12 in. high, bearing a rather densely many-fld. umbel or several umbels superposed: bracts shorter than the pedicels, ciliate, pubescent: fls. rose-purple or violet, the anthers yellow; calyx subtruncate at the base, pubescent, with lanceolate acute often unequal lobes; corolla pubescent, the limb yellow-tinted at the mouth with broad-obcordate emarginate lobes: caps. twice as long as the calyx. Cent. China. Intro. 1906. B.M. 8051. G.C. III. 37:344. G.M. 48:314. R.B. 36, p. 270. R.H.S. 39:144.—A very desirable hardy free-flowering species. *P. Veitchiana*, Petitm., is a different species, apparently not in cult.

80. *lichiangensis*, Forr. (*P. cortusoides* var. *lichiangensis*, Forr.). Much like *P. Veitchii*, but foliage less hairy and not white underneath, and fls. fewer, larger, and more drooping, with larger eye and purple anthers, the calyx somewhat inflated at base: plant 6-14 in. tall: lvs. petiolate, ovate-oblong, deeply cordate, lobed, and toothed: bracts lanceolate: fls. fragrant, rich rose-red or almost crimson in shade, the eye greenish yellow. Lichiang Range, N. W. Yunnan, China, altitude 10,000 ft. Intro. 1908. G.C. III. 50:472. R.H. 1912, p. 488. G. 35:9. R.H.S. 39:129.

81. *geraniifolia*, Hook. f. Very short-pubescent: lvs. about 2 in. long and broad, orbicular in outline, cordate at base, 11-15-lobed, the lobes triangular and many-toothed and acute, the slender petiole much exceeding the blade: scape 8-10 in. high, bearing 1 or 2 umbels: bracts small (about ½ in. long), linear: fls. rose-colored, on slender pedicels about ½ in. long; calyx campanulate, glabrous, the lobes acute; corolla exceeding calyx, the limb about ½ in. across, the lobes lightly emarginate. Tibet. R.H.S. 39:184.

82. *Paxiana*, Gilg. Plant tall and very showy: lvs. very thin-membranaceous, reniform from an open cordate base, acute, many-lobed, at first sparse-pilose on the nerves, somewhat ciliate, primary nerves 3, prominent, dividing ternately, the lobes shortly and broadly triangular, denticulate; the petiole much exceeding the blade: scape tall, 16-20 in. high, sparsely puberulent, bearing 3-4 superposed umbels which are 4-6-fld. and 1-2 in. apart: bracts small, almost subulate: fls. bluish lilac; calyx campanulate, somewhat strigose-puberulent with acute lobes; corolla cylindrical, the limb up to 1 in. across, with obovate, deeply bifid lobes. China.—The foregoing species may be difficult to separate from printed descriptions. In *P. Kaufmanniana* and *P. polynetra*, the lf.-lobes are oval and few-toothed; the former has a glabrous and the latter a pilose calyx. In *P. geraniifolia* and *P. Paxiana* the lobes are triangular

and many-serrate; in the former the corolla-tube is twice and in the latter thrice or more longer than the calyx.

V. MONOCARPICÆ.

Lvs. little if at all lobed: calyx leafy, often much enlarging after flowering: Chinese.

83. *malacoides*, Franch. FAIRY PRIMROSE. Fig. 3184. A slender and open grower, 8-20 in. high, larger and more branched than *P. Forbesii*, somewhat hairy below with white hairs, glabrous above: lvs. thin-papery, glabrescent, broad-ovate, under surface sometimes sparsely white-farinose, upper pale green, the base open-cordate, broadly 6-8-lobed, the lobes acutely incise-dentate; the petiole exceeding the blade: scape more or less exceeding the lvs., bearing 2-6 many-fld. superposed umbels which are distant from each other: bracts short, linear-lanceolate, acute, white-farinose below: fls. rose and lilac; calyx densely white-farinose, campanulate from a spherical base, with the lobes



3183. *Primula saxatilis*. Often cultivated under the name of *P. cortusoides*. (Separate fls. $\times \frac{1}{2}$)

short, acute, and spreading; corolla-tube cylindrical, slender, the limb a little concave, $\frac{3}{8}$ - $\frac{1}{2}$ in. across, with obcordate lobes: caps. globose, included. China. Intro. 1908. G.C. III. 44:396, 397; 52:308. R.H. 1912:156. Gn. 76, p. 157; 77, p. 291, 624. J.H. III. 60:399. G. 31:53. G.M. 51:914; 56:917. G.W. 13, p. 42. Var. *alba*, Hort., has white fls. Var. *plena*, Hort., has double fls. G.C. III. 54:428.—An excellent greenhouse species, blooming well in winter. Although perennial, it is usually treated as an annual; seed sown in spring should produce flowering plants in autumn. It blooms several months, bearing fls. in successive whorls on very slender sts., which sometimes reach a height of 18 in. It is now common in cult., and self-sows about the greenhouse. Several shades of color are represented, and also large-fld. forms which are possibly hybrids (see G.C. III. 55:180). The plant grows well out-of-doors in the

rock-garden in mild climates, with some protection. Often confounded with baby primrose (*P. Forbesii*), but the oblong long-petioled lvs. at once distinguish it, as well as the tall and open infl.

84. *pseudomalacoides*, Stewart. Much like *P. malacoides*, but more delicate in every way and said not to seed readily unless cross-pollinated: lvs. more prostrate, oblong. Yunnan, China. Intro. 1908.

85. *Forbesii*, Franch. BABY PRIMROSE. Figs. 3185, 3186. Handsome slender species, monocarpic in the form first intro. but a perennial as now grown: loosely white-hairy, at least on the lvs. and lower part of the scape: lvs. small, 1-2 in. long, oval-oblong to cordate-oblong, shallowly sinuate-toothed, minutely serrulate: scapes very slender, 6-14 in. high, much exceeding the lvs., often bent above the whorls: fls. small (about ½ in. across), light lilac, slender-pedicelled, appearing in successive umbels or whorls, the segms. obcordate, calyx sharp-toothed, small, somewhat loose. China; Burma, 3,000 ft. B.M. 7246. R.H. 1892, p. 259. G.C. III. 14:685; 35:20; 40:192. J.H. III. 49:287. R.H.S. 39:149. A.F. 14:757. Gng. 7:149. F.E. 11:72.—Although first described so recently as 1886, and first exhibited in London in 1891, this plant was once a common conservatory plant in America. It is a most profuse bloomer, beginning to flower when not more than 2 or 3 in. high and continuing until the scapes reach a height of 10-12 in. It is easily grown from seeds, and blooms well all winter. Unless given plenty of light and room, the scapes become weak and crooked. In recent years it has dropped from favor with florists, its place being taken in part by *P. malacoides*. Its botanical status is not well understood.

VI. MINUTISSIMÆ.

Plant very small or minute, producing stolons: lvs. toothed or crenate: Himalaya, Thibet.

86. *minutissima*, Jacq. Plant very small, stoloniferous, the stolons short and leafy: lvs. small, less than ½ in. long, sessile, spatulate-ovate or lanceolate, acuminate, dentate or crenate, more or less farinose below: scape very short, almost hidden among the lvs., 1-3-fld.: bracts 1-2, small: fls. strictly sessile, large in relation to the plant's size, purple; calyx glabrous, tubular-campanulate, split to the middle with acute lobes; corolla-tube slender, the limb ½ in. or less across, with obcordate, deeply emarginate lobes. Himalayas.

VII. OMPHALOGRAMMA.

Lvs. little if any lobed: fls. solitary on a bractless scape, the calyx little or not at all enlarging after flowering: China, Himalaya.

A. *Fls. appearing with or after the lvs.*

87. *vinciflora*, Franch. Plant with a short perennial rhizome: lvs. thin, papery, oblong or oval, densely overlapping and forming a narrow erect crown, all erect or nearly so, the upper ones larger, all entire but ciliate,

covered with reddish glands: scape short (6-9 in.): fl. solitary, purple-violet or blue, 1½ in. across, the tube cylindrical or long-obconic, yellowish at the base and covered with black glandular hairs outside; the segms. well separated and broadly obcordate, the 3 upper reflexed on the tube; calyx small, not inflated. China. B.M. 8564. G.C. III. 1:574; 40:230; 54:198. Gn. 77, p. 497; 79, p. 242.—A most odd species, with vinca-like fls., of simple cultural requirements.

88. *Elwesiana*, King. Rhizome scaly: lvs. about 4 in.

long, including the petiole, ovate-lanceolate, very remotely and scarcely denticulate, almost subentire, leathery, acute, glabrous, gradually narrowed to a winged, puberulent petiole: scape stout, 4-6 in. high, without bracts, red-hairy, 1-fld.: fls. violet; calyx pubescent, parted almost to the base, with lanceolate-linear, subobtusate lobes; corolla-tube pilose, broadened toward the throat, the limb funnelform, with almost quadrate lobes which are slightly narrowed toward their base and are almost truncate and denticulate at their apex: caps. cylindrical, equaling the calyx. Sikkim, Himalaya.

AA. *Fls. appearing before the lvs.*

89. *Delavayi*, Franch. Plant slightly soft white-hairy pubescent: lvs. long-petiolate, thin-papery, about 3 in. long and almost as broad, broadly ovate or suborbicular, the base more or less cordate, wavy-dentate or crenate: scape produced before the lvs., without bracts, 1-fld., densely pubescent, laxly enveloped up to the middle with fuscous, membranaceous, very broad scales: fls. bright purple; calyx broadly campanulate, deeply parted, with linear-lanceolate lobes about ½ in. long which are entire or denticulate and acute or obtuse; corolla outside pilose, the funnel form tube broad, slightly constricted above the base, then gradually broadened, the throat sprinkled with hairs, with oblong-ovate incised lobes: caps. ovate-oblong, ¾-1 in. long, ¾ in. thick. S.W. China.

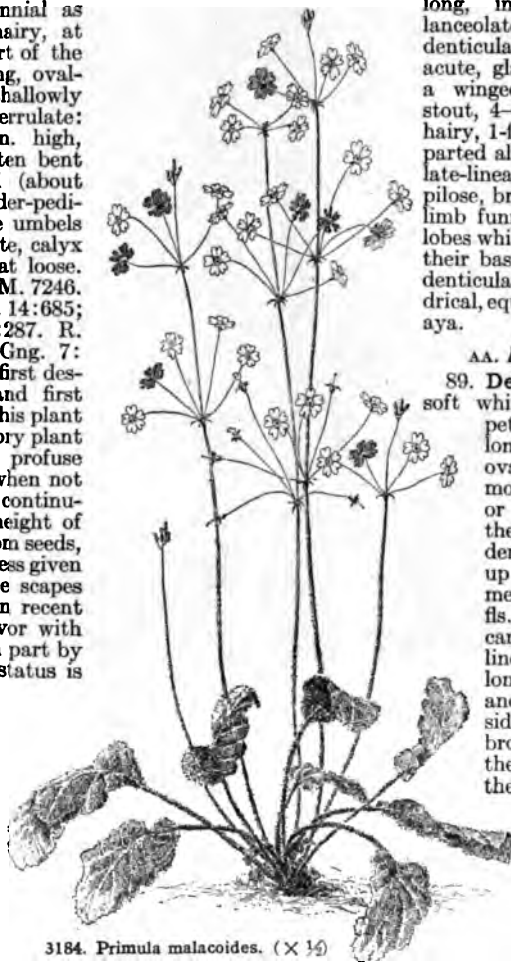
VIII. BULLATÆ.

Lvs. strongly rugose or bullate, hairy or glandular, more or less coriaceous, little

if any lobed, small (2-4 in. long): fls. pedicelled: China, Thibet.

90. *ovalifolia*, Franch. Lvs. membranaceous, finally subcoriaceous, ovate, obtuse, crenulate or subentire, ciliate, contracted abruptly to the petiole which equals or is shorter than the blade and is more or less covered with red hairs: scape 1-6 in. high, equaling or shorter than the lvs., somewhat red-hairy: bracts lanceolate, acuminate: fls. purple; calyx open-campanulate, with lanceolate acuminate, hairy lobes; corolla-tube broadened to the concave limb, which is up to 1 in. across, with obovate slightly emarginate lobes. Cent. China. Intro. 1906. G.C. III. 38:70.

91. *Forrestii*, Balf. f. Beautiful undershrub of very recent intro., not farinose, with glandular fragrant foliage, and in its native places producing rootstocks 2-3 ft. long and probably in some cases 50-100 years old: lvs. petiolate, ovate-elliptic, attenuate or sub-



3184. *Primula malacoides*. (X ½)

cordate at base, irregularly bi-crenate, rugose above and densely farinose beneath: scape stout and erect, 3-9 in. high and equaling or exceeding the lvs., bearing a 10-25-fld. umbel: bracts leafy, lanceolate: fls. on slender erect pedicels, large, fragrant, deep orange (or deep yellow?) with an orange-yellow tube; corolla-limb nearly 1 in. across, the lobes ovate or rounded and deeply emarginate; calyx pouch-like or scarcely campanulate: caps. ovoid. Pendulous from dry shady crevices of limestone cliffs of the Lichiang Range, S. W. China; in cult. said to thrive in limestone well-drained soil in the alpine rockery. Intro. 1908. B.M. 8313. G.C. III. 45:274, 299; 51:240. R.H.1912, p. 490. Gn. 73, p. 242. G.M. 52:325. G. 31:289; 36:209. R.H.S. 39:152.—Placed in a new section *Suffruticosa* by Balfour, together with several others. A very recent and interesting species of this group is *P. rufa*, Balf., with golden meal and hairy: fls. yellow. Yunnan, China.

92. *rédolens*, Balf. f. Allied to *P. Forrestii* and in foliage much resembling it but softer and more hairy: scapes 6-9 in. tall, bearing umbels of 12-20 fls. that vary in color from white to pale pink and splashed purple, with a small yellow eye. W. China; a very recent intro., and probably not yet tested in this country.

93. *cærulea*, Forr. Rhizome not woody: lvs. petiolate, 2-4 in. long, ovate or ovate-elliptic, densely pubescent beneath and mostly bullate (puckered) above, at the base more or less attenuate, at the apex rounded, sinuate-crenate: scape 1-3 in. high, more or less woolly, 1- or 2-fld.: calyx broadly bell-shaped, lightly pubescent, the lobes triangular and acute; corolla purplish blue, the tube funnelform and throat greenish yellow, the limb 1 in. or more across, lobes broadly obovate and entire or nearly so. China, on rocks in exposed situations. Intro. 1911.

IX. CAROLINELLA.

Much like *Bullata*, but lvs. larger: Asia Minor, China.

94. *megaseæfolia*, Boiss. More or less somewhat ferruginously-pilose, at length almost glabrous everywhere: lvs. chartaceous, rotund or ovate-rotund, obtuse, the base slightly cordate or subrotund, remotely somewhat spinulose-dentate, glabrous above, ferruginous-pubescent along the nerves below; the petioles stout, more or less equaling the blade, narrowly winged: scape shorter than or equaling the lvs., glabrescent, bearing 1 or 2 closely approximate superposed many-fld. umbels: bracts lanceolate, with a subulate-acuminate apex; pedicels slender, nodding white infl.: fls. rose; calyx glabrous, narrowly tubular, 5-ribbed, with lanceolate, acute, slightly reflexed lobes; corolla-limb 1 in. across, with obcordate, deeply emarginate lobes: caps. glabrous, oblong, exceeding the calyx. Mountains of Asia Minor, B.M. 7901. G.C. III. 29:223. Gn. 59, p. 298; 65, p. 323. G.M. 44:287. G. 32:347. Gn.W. 20:211. F.S.R. 2:24. R.H.S. 39:117.—An interesting and distinct species, suitable for outdoor planting.

X. FALLACES.

Lvs. membranaceous, rugose, hairy, cordate at base. distinctly petiolate: infl. bracteate, about 2-3-fld. Japan.

95. *Reinii*, Franch. Densely covered with long, many-celled hairs, especially the petioles and the upper surfaces of the lower lvs.: lvs. petiolate, 4-6 in. diam., rotundate or reniform, base deeply cordate, incise-crenate to scarcely one-third the depth of the blade the lobes with the edges overlapping: scape scarcely longer than the lvs., bearing 2-6 fls.: bracts lanceolate: fls. pale violet; calyx glabrous, lobed to the middle, the lobes ovate, obtuse, and callous-mucronate; corolla with deeply bifid lobes. Japan. G.M. 58:207. R.H.S. 39:177.

96. *tosaënsis*, Yatabe. Lvs. petiolate, membranaceous, pubescent below, ciliate, about 2 in. diam., base cordate, orbicular or very broadly ovate, slightly lobed, the lobes acute, dentate; the petioles pubescent, subequaling the blades: scape exceeding the lvs., pubescent, glabrescent toward the top, bearing a simple 2-4-fld. umbel or 2 superposed umbels: bracts short, subulate: fls. pale purple; calyx tubular, split scarcely to the middle with narrowly triangular lobes; corolla-tube slightly dilated toward the top, the limb about $1\frac{1}{4}$ in. across, the mouth annular; the lobes ovate, emarginate: caps. long-cylindrical, very much longer than the calyx. Japan. Gn. 79, p. 266.

XI. VERNALES.

Lvs. membranaceous, rugose, gradually attenuate at base (rarely cordate): fls. pedicelled: handsome species: Eu., Asia. This is a group of spring-flowering plants to which the polyanthus and the true cowslip belong. They are much varied and hybridized, and the botany of them is therefore much confused.

A. Limb of corolla concave; calyx open-campanulate.

97. *veris*, Linn. (*P. veris* var. *officinālis*, Linn. *P. officinālis*, Hill. *P. odorata*, Gilib. *P. domestica*, Hoffing. *P. coronaria*, Salisb.). Cowslip. Fig. 3187. Stemless, minutely soft-pubescent: lvs. rugose, membranaceous or chartaceous, ovate or ovate-oblong, obtuse, more or less contracted or narrowed to the petiole, crenate, more or less pilose or canescent or white-tomentose below; the petiole winged, shorter than or equaling the blade: scape pubescent, bearing a many-fld. umbel, 4-8 in. high: bracts linear, acute, small: fls. fragrant, bright golden or light yellow, rarely purplish; calyx pubescent, campanulate, more or less broadened, 5-ribbed, whitish, with triangular, acute frequently mucronulate lobes; corolla-limb concave, rarely somewhat flat, expanding little beyond the bulge of the calyx, $\frac{1}{2}$ -1 in. across, with obcordate obtuse emarginate lobes: caps. oval, included in the calyx. S. Cent., and N. Eu., Britain, Asia. G.W. 4, p. 245 (var. *grandiflora*); 13, p.74; 15 p. 270.

The cowslip is a variable species, with a strong tendency to abnormal development of the calyx. Var. *macrocalyx* (*P. macrocalyx*, Bunge. *P. officinālis* var. *macrocalyx*, Koch), Asian, has calyx about $\frac{3}{4}$ in. long and broadly obconic at base, the lobes short-triangular and acute-mucronate: corolla exceeding calyx, orange-yellow, $\frac{3}{4}$ -1 in. or more across: lvs. usually more or less tomentose or subcanescent beneath (sometimes greenish), attenuate or contracted into a winged petiole.



3185. *Primula Forbesii*, the baby primrose, at the beginning of its blooming season.

Var. *inflata*, Reichb. (*P. inflata*, Duby. *P. canescens*, Opiz. *P. officinalis* var. *canescens*, Beck. *P. pannonica*, Kerner). Calyx equaling or surpassing corolla-tube, more or less open-campanulate, about $\frac{1}{4}$ in. long; corolla $\frac{1}{2}$ – $\frac{3}{4}$ in. across: lvs. contracted or narrowed into petiole, cano-tomentose or glabrescent beneath.



3186. *Primula Forbesii*. ($\times \frac{1}{2}$)

G.W. 15, p. 269.—Var. *gigantea*, Hort., is offered, with fls. more than 1 in. across, yellow predominating. For cowslip \times oxlip, see New Phytologist, vi:162 (1907).

From the cowslip the oxlip differs in having the fls. more or less upright, the corolla-limb is plane and the throat is open without folds. The species is widely variable. Var. *carpathica*, Griseb. Lvs. ovate or oblong, the petiole more or less winged and the blade strongly rugose and crenulate: calyx usually ventricose-tubular before flowering: caps. cylindrical. Carpathians. Var. *intricata*, Pax. Lvs. ovate-elliptic, gradually attenuate into a winged petiole, little rugose, green beneath: scape only equaling the lvs.: calyx tubular, the lobes triangular and acute: caps. short-cylindrical, equaling or perhaps exceeding the calyx. S. Eu. Var. *Pallasii*, Pax (*P. Pallasii*, Lehm. *P. altaica*, Pall.). Lvs. oblong or elliptic, gradually attenuate into petiole, nearly glabrous, little or not at all rugose: calyx very narrowly tubular, the lobes very narrow and recurved at apex. Urals, Caucasus, N. Persia, Altai. Var. *cordifolia*, Pax (*P. cordifolia*, Rupr.). Lvs. round-ovate, cordate at base, the petiole wingless or narrowly winged, nearly glabrous, scarcely rugose: calyx very narrowly tubular, the lobes very narrow and at apex recurved. Caucasus and Armenia.

99. *pseudoeclatior*, Kusn. Differs from *P. elatior* in calyx-lobes being broad-lanceolate and about equaling the length of the tube: lvs. ovate, hairy, rugose, green beneath,

Var. *suaveolens*, Reichb. (*P. Columnae*, Ten. *P. officinalis* var. *Columnae*, Pax). Calyx campanulate; corolla-limb little concave or almost plane, about $\frac{3}{4}$ in. across: lvs. ovate to oblong-ovate, cordate, densely white-tomentose beneath.

AA. Limb of corolla plane.

B. Scape evident.

C. Fls. yellow.

98. *elatior*, Hill. OXLIP. Lvs. rugose, membranaceous, ovate or oblong, the apex, obtuse, more or less contracted or narrowed to the petiole, crenulate or denticulate, more or less pilose or canescent-tomentose below; the petiole more or less winged, shorter than or equaling the blade: scape more or less pubescent, 4–8 in. high, bearing a many-fl. umbel: bracts linear, acute, small: fls. pale yellow, turning green in drying, scentless; calyx more or less pubescent, 5-ribbed, tubular, with narrowly lanceolate acute lobes that are shorter than the tube; corolla-tube cylindrical, the limb flat, more or less than $\frac{1}{4}$ in. across, with obcordate, emarginate lobes: caps. cylindrical or oblong, equaling or exceeding the calyx. Eu., especially in the mountains and the northern part, southeast to Caucasus and Persia. Gn. 62, p. 217.

abruptly contracted into petiole, the base cordate to truncate: scape exceeding the lvs., bearing a simple umbel: corolla yellow, with plane limb: caps. rounded, much shorter than calyx. Caucasus.

100. *leucophylla*, Pax. Differs from *P. elatior* in the lvs. being densely white-tomentose beneath: lvs. somewhat coriaceous, oblong or elliptic, obtuse, rugose, petiolate: scape exceeding the lvs., pubescent but becoming more or less glabrescent, bearing a many-fl. umbel: corolla yellow, scarcely exceeding the calyx, the limb plane, lobes obcordate: caps. cylindrical, equaling or less than the calyx. Carpathians.

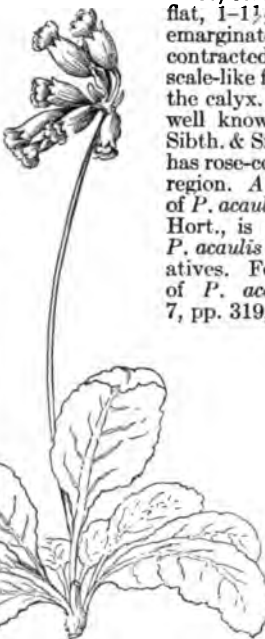
CC. Fls. violet, rarely white.

101. *amena*, Bieb. Lvs. submembranaceous, somewhat roughened or thin, narrowed to the petiole or abruptly and longer petioled, in which case the base is cordate or subcordate, sometimes minutely denticulate or subentire, sometimes decidedly coarse-crenate, ashy tomentose or glabrous below; the petiole equaling the blade: scape 1–5 in. high, exceeding the lvs., bearing a many-fl. umbel: bracts short-lanceolate, acuminate; fls. purple or lilac, rarely white; calyx narrowly tubulate, with lanceolate acuminate lobes; corolla-tube cylindrical, the limb flat, $\frac{3}{4}$ – $1\frac{1}{4}$ in. across, with obcordate emarginate lobes: caps. cylindrical, equaling or exceeding the calyx. Caucasus region to Asia Minor, in several varieties. B.M. 3252.

BB. Scape none or nearly none, the umbels therefore borne in the foliage and the fls. standing singly on the long rays.

C. Lvs. not white-tomentose beneath.

102. *acaulis*, Hill (*P. vulgaris*, Huds. *P. veris* var. *acaulis*, Linn.). PRIMROSE. Lvs. many, tufted, somewhat wrinkled, membranaceous, oblong or obovate-oblong, apex obtuse, gradually rarely evenly narrowed to the petiole which is shorter than the blade, sometimes sessile, more or less pilose or glabrescent, crenulate; the petiole more or less winged: scape none; pedicels $2\frac{1}{2}$ –4 in. long, more or less equaling the lvs., soft-pubescent, as is the calyx: fls. pale yellow, or rarely purple or blue, becoming greenish in drying; calyx ovate-tubular, 5-ribbed with narrow-lanceolate, acuminate lobes; corolla-tube cylindrical, the limb flat, $1\frac{1}{2}$ –2 in. across, with obcordate emarginate lobes, the throat slightly contracted and bearing a circle of scale-like folds: caps. ovate, included in the calyx. Eu., widely distributed and well known. B.M. 229. Var. *rubra*, Sibth. & Smith. *P. Sibthorpiae*, Hoffm.), has rose-colored or purple fls. E. Medit. region. *A. anisaca*, Stapf, is a hybrid of *P. acaulis* and *P. elatior*. *P. Croussei*, Hort., is probably a garden form of *P. acaulis* or one of the hybrid derivatives. For pictures of various forms of *P. acaulis* or *vulgaris*, see Gn. 7, pp. 319, 345; 11, p. 127; 12:496; 29, p. 385; 54:142, and pp. 142, 143. A.F. 13:1102. Gng. 6:245. R.H. 1880: 90; 1898:12. In cult., the primrose runs into many forms and colors, some of them double-fl. More or less caulescent forms (var. *caulescens*, Hort.) are probably hybrids.



3187. The cowslip.—*Primula veris*. ($\times \frac{1}{4}$)

103. *Polyantha*, Hort. Fig. 3188. A garden group supposed to be hybrids of *P. veris* or *P. elatior* and *P. acaulis*, although some botanists refer it to *P.*

elator direct, and some consider it to be a direct development of *P. acaulis*, with elongated scapes. Whatever its origin, the group is distinct for garden purposes, and it is the commonest form of hardy primula known in American gardens. The fls. are several to many in an erect umbel that usually stands well above the long lvs.; the colors are mostly yellow and red-and-yellow, running into orange, bronze, and maroon, and sometimes pure white. Gn.M. 2:59.—There is a form with one corolla inside the other, known as duplex or hose-in-hose. The polyanthus is perfectly hardy, blooming in earliest spring. Prop. easily by seeds sown as soon as fully ripe; also by division. *P. variabilis*, as used in horticultural literature, usually refers to this Polyanthus group or to plants of similar origin.

cc. *Lvs. white-tomentose beneath.*

104. *Jölise*, Kusn. Lvs. thin, glabrous, reniform-orbiculate or ovate-orbiculate, base cordate, coarsely crenate, abruptly passing into the somewhat winged petiole which is 2-3 times as long as the blade: scape none: pedicels numerous, 2-3 times longer than the lvs.: fls. rose or red; calyx glabrous, narrowly tubular, angled, with narrow-lanceolate very acuminate lobes; corolla-limb flat, $\frac{3}{4}$ -1 in. across, with narrow deeply obcordate lobes. Transcaucasus. Intro. 1910. B.M. 8468. G.C. III. 51:293. R.H. 1914, p. 251. Gn. 78, p. 194. G. 35:327.—Said to be a free grower, liking moisture, and producing its red fls. in profusion.

XII. SOLDANELLOIDEÆ.

Lvs. more or less hairy or pubescent: fls. sessile or very nearly so: involucre bracts short and broad: Himalaya, China.

A. *Infl. spicate.*

105. *spicata*, Franch. Lvs. membranaceous, short-pubescent on both surfaces, petiolate, with the petiole $1\frac{1}{2}$ -3 in. long, ovate or oblong-ovate, obtuse, short-attenuate at base, double-serrate; the petiole narrowly winged and shorter or longer than the blade: scape slender, 2-3 times longer than the lvs., glabrous, short-pubescent toward the top: infl. elongated, 1-sided, spicate: bracts lanceolate: fls. sessile, horizontal or somewhat pendulous, violet; calyx campanulate, sparsely white-farinaceous, triangular, acute; corolla-tube short, abruptly dilated into a broad flattened cup-shaped limb, ovate, emarginate, the apex erose-dentate: caps. globose, about equaling the calyx. China. Intro. 1908. R.H.S. 39:157.

AA. *Infl. capitate or umbellate (fls. sometimes solitary).*

B. *Fls. several or many.*

106. *Wattii*, King (*P. Gillii*, Hort.). Lvs. covered with flexuous white hairs especially on the nerves and margin, glabrescent, membranaceous, oblong-lanceolate, gradually narrowed to the petiole which equals the blade, coarsely crenate-dentate, the teeth entire or crenulate: scape $4\frac{1}{2}$ -6 in. high, many-flid., glabrous: bracts membranaceous: fls. sessile, nodding, violet; calyx open cup-shaped, membranaceous, with lobes which are quadrate or semi-orbicular in outline and dentate; corolla glabrous, the limb broad-funnelform, broad-obcordate, emarginate as well as crenulate. Sikim-Himalaya. B.M. 8456. G.C. III. 51:286. Gn. 76, p. 191. R.H.S. 39:192.

107. *florida*, Balf. f. & Smith. Lvs. long-stalked, the blade ovate, covered beneath with white meal (farina): scape very much overtopping the lvs., which spread on the ground: fls. in umbel, short-stalked, with mealy calices, the corolla purple-blue, and rapidly fading to paler tint. Yunnan, China. G.C. III. 57:207.—A humus-loving species.

108. *dryadifolia*, Franch. Glabrous: lvs. small, ovate crenulate, contracted to a petiole about $\frac{1}{4}$ in. long or subcordate, white-farinose below or devoid of farina:

scape 2-3 times longer than the lvs., puberulent, bearing 3-5 fls. which are clustered: bracts broad-ovate, sometimes tridentate, green or becoming purple, sparsely farinose: fls. subsessile, violet; calyx broadly campanulate, split scarcely to the middle with ovate, obtuse, entire or minutely crenulate lobes; corolla-limb flat, $\frac{1}{2}$ - $\frac{3}{4}$ in. across, with noticeable 4-lobulate lobes: caps. ovate-oblong, about equaling the calyx. China. Intro. 1911.

109. *pinnatifida*, Franch. Lvs. clothed with soft, white hairs especially so on the nerves and margin, petiolate, $1\frac{1}{2}$ in. or less long, ovate or oblong, base cuneate, entire, or else incise-lobed, the lobes quadrate or ovate, the lower and upper smaller, entire, the intermediate variously lobed; the petioles narrowly winged,



3188. Polyanthus.—*Primula Polyantha*. ($\times \frac{1}{4}$) No. 103.

equaling the blades: scape 2-3 times longer than the lvs., glabrous, somewhat farinate toward the top: bracts lanceolate, acuminate, frequently colored: fls. capitate, reflexed, violet; calyx becoming violet, sparsely golden-farinose, campanulate, with ovate, obtuse lobes frequently denticulate or erose at the apex; corolla-tube cylindrical, the limb cup-shaped, less than $\frac{1}{2}$ in. across, with ovate, entire or scarcely emarginate lobes. China. Intro. 1908. R.H.S. 39:156.

110. *cérnua*, Franch. Closely allied to *P. pinnatifida*, whose fls. have similar capitate infl., differs however in having the lvs. broadly ovate, short, indistinctly petiolate, margins scarcely conspicuously crenulate: bracts of the involucre ovate not lanceolate: calyx-lobes ovate, mucronate not rounded or crenulate at the apex: fls. blue. China.

BB. *Fls. few or only 1.*

c. *Blossoms large for the plant.*

111. *Reidii*, Duthie. Lvs. membranaceous, upper surface convex, puckered, laxly silky-villous, oblanceolate, obtuse, coarsely lobulate-dentate or -crenate, narrowed to a winged petiole which is shorter than the blade: scape stiff, up to 4 in. high, several-flid.: bracts broad: fls. subsessile, nodding, ivory-white; calyx campanulate, white-farinose inside, with broad, rotundate, obtuse, glandular-ciliate lobes; corolla-lobes broad-oblong, closed in a globe almost $\frac{3}{4}$ in. diam., the apex 2-cleft with a tooth between. Himalaya. B.M. 6961. G.C. II. 26:693; III. 49:195. Gn. 77, p. 231. G.M. 58:288. R.H.S. 39:185.

112. *uniflora*, Klatt. Devoid of farina, small: lvs. small, membranaceous, sparsely white-villous, broad-ovate or orbicular-ovate, acute, base truncate or acute, incise-dentate or crenate; the petiole slender, equaling or exceeding the blade: scape slender, long, exceeding the lvs., 1-2-fld.: bracts minute, oblong: fls. large in relation to the plant, sessile, nodding, pale violet; calyx campanulate, membranaceous, deeply 5-lobed, the lobes quadrate, truncate, apiculate, frequently undulate-crenulate; corolla funnelform, the limb almost $1\frac{1}{4}$ in. across with broad, coarsely dentate lobes: caps. globose. Sikkim-Himalaya. R.H.S. 39:186.

113. *pusilla*, Wall. Plant minute, cespitose, small-lvd., small-fld., and the habit of an androsace: lvs. less than $\frac{1}{2}$ in. long, spreading-recurved, spatulate or oblanceolate, obtuse, pinnatifid, somewhat strigose-pilose above, more or less puberulous below, the midrib stout, toward the base narrowed to a petiole which can scarcely be distinguished from the blade: scape slender, about 2 in. high, bearing 1-4 fls. in a head: bracts ovate-lanceolate: fls. purple or violet; calyx farinose, campanulate, with triangular acute lobes; corolla-tube densely villous at the throat, the limb almost $\frac{1}{2}$ in. across, with spreading, obcordate, emarginate lobes; ovary depressed-globose. Himalaya. B.M. 7079. R.H.S. 39:208.

cc. *Blossoms small for the genus: plant minute.*

114. *sapphirina*, Hook. f. Very small and densely cespitose, small-lvd. and small-fld., glabrous or nearly so: lvs. $\frac{1}{4}$ - $\frac{1}{2}$ in. long, cuneo-spatulate or obovate, narrowed into petiole, pinnatifid: scape slender, 1-2 in. high, 1-4-fld.: bracts minute, lanceolate: fls. very short-pedicelled, nodding, capitate or essentially so, violet; calyx cup-like with triangular lobes; corolla funnelform, with short tube, scarcely surpassing the calyx, the limb about $\frac{1}{2}$ in. diam., lobes ovate and emarginate. Sikkim, 12,000 to 15,000 ft. altitude. B.M. 6961.

XIII. CAPITATÆ.

Much like the *Soldanelloideæ*, but bracts subulate or lanceolate: fls. sessile or pedicelled: W. Himalaya to China.

a. *Fls. erect; calyx tubular-campanulate.*

115. *erösa*, Wall. (*P. capitata* var. *crispa*, Hort. *P. denticulata* var. *erösa*, Duby). Glabrous or puberulous, 5-7 in. high: lvs. appearing with the fls., not farinose, somewhat pellucid, slender reticulate-veined, obovate-spatulate or oblanceolate, obtuse, gradually narrowed to the petiole which can scarcely be distinguished from the blade, sharply erose-denticulate: scape slender, 8-10 in. high, much exceeding the lvs., bearing a many-fld. umbel: bracts small, triangular, farinose: fls. purple or violet; calyx open tubular-campanulate, the tube short, with lanceolate acute lobes; corolla-limb about $\frac{1}{2}$ in. across, with obcordate emarginate lobes: caps. included in the calyx. Temp. Himalaya. B.M. 6916 A. Gt. 2, p. 130. Gn. 62, p. 131. G.L. 16:95. R.H.S. 39:187.—Said to require a moist place or a bog in the rock-garden. Hooker says that the lvs. are sometimes 18 in. long.

116. *denticulata*, Smith. Scapes 4-18 in. tall, bearing a dense umbel or head of pale purple fls.: lvs. in a rosette on the crown, usually not full grown until the fls. are past, and surrounded beneath by short, broad, thick, lf.-like bracts; lf.-blades oblong-obovate or spatulate, usually narrowed into a winged stalk, sharply denticulate, more or less mealy: corolla-tube about twice as long as the calyx-teeth, the corolla-lobes obcordate. Himalaya region, 7,000-13,000 ft., and said by Hooker to be "the commonest Himalayan primula, and very variable." The fls. are said to be eaten in salad and the powder of the roots to be used in killing leeches. Intro. 1842. B.M. 3959. B.R. 28:47. Gn. 11, p. 127; 29, p. 382; 35, p. 529; 41, p. 588; 62, p. 218; 79, p. 161.

G.M. 54:344. G.C. III. 47:152. J.H.III. 62:261; 67:529. R.H.S. 39:160.—A hardy plant, usually treated as a rockwork subject. Blooms in earliest spring. Var. *purpurea*, Hort., has dark purple fls. Var. *alba*, Hort., has white fls. Gn. 50, p. 372; 78, p. 165. G.L. 23:422. Gn.W. 22, suppl. May 13 (as var. *alba grandiflora*). Var. *pulcherrima*, Hort., is very robust, with deep purple fls. in dense heads. Var. *variegata*, Hort., has lvs. bordered white. Var. *Fire Ball* has bright purple fls. in large heads.

Var. *cachemiriæna*, Hook. f. (*P. cachemiriæna*, Munro. *P. cashmeriana*, Hort.). Lvs. nearly or quite full grown when the fls. are in bloom, usually more mealy (yellow-mealy beneath and sometimes on top): fls. rich purple with yellow center: perhaps a hybrid. W. Himalayan region. R.H. 1880:330. J.H.III. 60:199. Gn. 79, p. 97. *P. sibirica* var. *kashmiriana*. (B.M. 6493) is a different plant. See No. 132.

117. *pseudodenticulata*, Pax. Glabrous: lvs. chartaceous, appearing with the fls., linear-oblong, obtuse or acute, scarcely noticeably denticulate, almost entire, not farinose, gradually narrowed to the winged petiole: scape stiff, exceeding the lvs., $1\frac{1}{2}$ -4 in. high, sparsely farinose below the top, bearing a head of many fls.: bracts lanceolate, acuminate from a broad base: fls. lilac, the outer ones of the head opening long before the inner ones; calyx tubular-campanulate, whitc-farinose, with narrowly triangular, obtuse pilose lobes which do not turn black; corolla-limb annulate at the throat, about $\frac{1}{2}$ in. across, with broad-obcordate, deeply emarginate lobes. S. W. China. Intro. 1908. G.C. III. 53:264.—Another recent species of this group is *P. nensensis*, Forr., with bright pink fls., "of considerable merit" for both indoors and outdoors; scape slender and much overtopping the oblong-rugose or bullate lvs. R.H.S. 39:160. It is said that this is the name for the plant that has been distributed as *P. farinosa* var. *Beesii*, and also for some of the *P. pseudodenticulata*.

118. *glabra*, Klatt. Lvs. not farinose, membranaceous, small for the size of the plant (about $\frac{1}{2}$ in. long), ovate-spatulate, obtuse, erose-dentate, attenuate into a narrow petiole-like base: scape slender, 2-3 in. high, bearing a close head-like umbel: bracts small, acute: fls. purple-violet, very short-pedicelled; calyx tubular-campanulate, incised or cut scarcely one-third the length, the lobes obovate and very obtuse; corolla-tube scarcely exceeding the calyx, the lobes narrowly obcordate and bifid. Sikkim-Himalaya, 12,000-15,000 ft. and more altitude. R.H.S. 39:192.—Apparently cult. only very recently.

AA. *Fls., or the outer ones, reflexed, nodding or pointing downward; calyx mostly globose-campanulate.* (Some of the plants of this group have been associated by Balfour as a section *Muscarioides*, with a muscari-like flower habit. "The characteristic feature of the group is the aggregation of small fls., which have tubular corollas with a short erect limb, in a close spike or capitulum, in which they are all inserted with the mouths of the corollas downwards.")

B. *Calyx-teeth acute.*

119. *capitata*, Hook. Lvs. appearing with the fls., oblong-lanceolate, obtuse or acute, finely denticulate, more or less intensely white-farinose below, narrowed to the petiole, which is shorter than the blade and frequently scarcely distinct from it: scape 8-16 in. high, stout, slightly thickened toward the top, bearing a dense, rarely a little lax, many-fld. head: bracts lanceolate, acute: fls., the outer ones, opening long before the inner, reflexed or nodding, the inner forming a dense crown, bright purplish blue; calyx open-campanulate, scurfy, split to the middle, with the lobes triangular acute, rather concave, about $\frac{1}{2}$ in. across with obcor-



XCII. A plant of *Primula obconica*.



20

date emarginate lobes. Himalaya. B.M. 4550. F.S. 6:618. Gn. 16:534; 29, p. 382; 45, p. 503; 50, p. 373; 54, p. 467; 76, p. 183; 79, p. 124. J.H. III. 32:209; 50:407. J.F. 1:80. In China this species is represented by forms regarded as distinct species, as in Nos. 120 and 121. Var. *grandiflora*, Pax, is a culture-form with large fls. in a more open head, the fls. being very short-pedicelled. B.M. 6916 B.

120. *pseudocapitata*, Ward. A Chinese (Yunnan) representative of *P. capitata*, with smaller trusses of purple fls.; bracts cut. Intro. 1911.

121. *sphaerocéphala*, Balf. f. & Forr. Much like *P. capitata*, with small globular heads, the fls. purplish inside, not annulate, bracts fimbriate: delicately perfumed. S. W. China.—This and No. 120 are distinguished from No. 119 by the much smaller corolla-limb and more globular heads.

122. *Giraldiana*, Pax (*P. muscarioides*, Hemsl.). Not farinose, 8–12 in.: lvs. flaccid, very thin-membranaceous, glabrescent, the younger ones cobwebby-pilose below, especially on the nerves, narrowly oblong, acute or obtuse, lobulate-crenate-dentate, long-narrowed to a winged petiole which is shorter than the blade: scape 8–12 in. high, glabrous, bearing a many-fl., globose-cylindrical head: fls. strictly sessile, reflexed, blue; calyx open-campanulate, split below the middle, with ovate, acute, denticulate, ciliate lobes; corolla-tube slender, the limb rather concave, about $\frac{1}{4}$ in. across, with broad-ovate, entire, very obtuse not emarginate lobes: caps. globose, little exceeding the calyx. Shensi, in Cent. China. Intro. 1908. B.M. 8168. R.H.S. 39:153.—Said to require a moist and somewhat shaded place.

BB. Calyx-teeth obtuse.

C. Corolla-lobes less than half the exerted part of the tube.

123. *deflexa*, Duthie. Rootstock short and rather stout: lvs. rosulate, rather thin, 5–11 in. long, narrowly oblanceolate, obtuse or subacute at apex, tapering to long winged petiole, minutely white-hairy, irregularly crenate-dentate, the teeth with reddish gland-like tips: scape often 2 ft. high, much exceeding the lvs., bearing nearly globose heads about 1 in. diam. of crowded sessile deflexed dark blue or rose-purple fls. with a delicate blue center and which often turn whitish after expansion: calyx about $\frac{1}{4}$ in. long, yellow-farinose, unequally lobed; corolla about $\frac{1}{2}$ in. long, glabrous, funnel-shaped, the lobes cuneate-oblong and broadly emarginate: caps. depressed-globose in form. W. China, 10,000–13,000 ft. altitude. Intro. 1906. R.H.S. 39:153.

124. *bellidifolia*, King. Puberulous: lvs. thin-flaccid, not farinose, oblanceolate or spatulate, irregularly sublobately dentate, obtuse, narrowed to a petiole more or less equaling the blade: scape 4–8 in. high, glabrous, exceeding the lvs., bearing a dense many-fl. head: bracts small: fls. reflexed, purplish blue; calyx open-campanulate, puberulent, split below the middle, with ovate obtuse farinose lobes; corolla-tube slender, the throat constricted, annulate, the limb about $\frac{1}{4}$ in. across, concave, with obcordate lobes: caps. globose. Sikkim.

125. *Watsonii*, Dunn. Lvs. sessile and rosulate, 3–6 in. long, oblanceolate, obtuse, long-attenuate at base, more or less lobulate-crenate, hirsute on veins and not farinose: scape strict, very much exceeding the lvs. (to 1 ft. high), glabrous, farinose at apex, bearing a small globose or ovate spike or head of many sessile deep purple fls. which are $\frac{1}{8}$ – $\frac{1}{2}$ in. long: calyx broad-campanulate, the 5 broad-ovate ciliate teeth equaling the tube; corolla glabrous, dark purple, the tube cylindrical, the limb cup-shaped, the lobes truncate or obtuse: caps. ovoid. W. Szechuan, China.—Scapes powdery yellow. Intro. 1911. R.H.S. 39:157.

cc. Corolla-lobes more than half as long as the exerted part of the tube.

126. *Littoniana*, Forr. Plant 2 ft. or more, with spikes resembling those of kniphofia: lvs. broadly lanceolate, attenuate into petiole, rounded at apex, irregularly dentate, hairy, about 8 in. long: scape thick, erect, much exceeding the lvs., farinose toward the top, bearing a dense many-fl. elongated spike (which is 3–5 in. long) of violet-blue, sessile or short-pedicelled fragrant fls.: bracts linear, farinose: calyx broadly campanulate, deeply cut or split, the scarlet lobes ovate or ovate-lanceolate and acute; corolla-tube exceeding calyx, the limb concave and about $\frac{1}{2}$ in. diam., the lobes narrow-ovate and entire with rounded apex: caps. small, globose, not exceeding the calyx. S. W. China, 10,000–11,000 ft. altitude. Intro. 1908. B.M. 8341. G.C. III. 46:14, 15. Gn. 73, p. 361. G.M. 52:528. R.H.S. 39:156.—“Named to commemorate the late Consul Litton of Tengyveh.” *P. Vidli*, Franch., is very like this species but smaller and lacking the hairs; the plant described under this name in Pax’s monograph is said to be a chimera or confusion of *P. deflexa*, *P. gracilentia*, and *P. Watsonii*. *P. cernua* (No. 110) is by recent authors associated with this group.

127. *gracilentia*, Dunn. Perennial, not farinose: lvs. petioled, in rosettes, oblong and obtuse, narrowed at base, irregularly dentate and wavy, hairy: scape slender, 6–8 in., bearing a head of sessile deflexed deep lilac fls., subtended by lanceolate bracts; calyx broad-campanulate, the teeth ovate and more or less ciliate; corolla with cylindrical tube, the lobes oblong and terminated by short tail, giving a fringed effect to the corolla. Yunnan. Intro. 1915. G.C. III. 57:207.—A humus-loving species.

XIV. FARINOSÆ.

Lvs. glabrous or minutely pubescent: involucrel bracts gibbous or saccate at base: widespread in arctic and subarctic regions of both hemispheres and in mountains of Eu., Asia, to Japan.

A. Fls. sessile or very nearly so.

128. *algida*, Adam. Farinose or not so: lvs. glabrous, oblong-spatulate or oblong, obtuse, gradually narrowed to a short, frequently obscure, winged petiole, minutely and sharply denticulate or subserrate, rarely with the lower margin subentire: scape exceeding the lvs., 1–8 in. high, bearing a frequently many-fl. umbelliform head or rarely a congested umbel: bracts lanceolate, acuminate, their base subsaccate: fls. violet; calyx split to the middle, the teeth lanceolate, rather obtuse or rather acute, black, rarely green; corolla-limb about $\frac{3}{4}$ in. across, with obcordate trifid lobes: caps. oblong, more or less equaling the calyx. Caucasus, Asia, and Asia Minor, in several marked forms. Gn. 78, p. 180. R.H.S. 39:96.—For shady cool parts of rock-garden; May, June.

129. *auriculata*, Lam. (*P. longifolia*, Curt.). Lvs. glabrous, not farinose, membranaceous, elliptic, lanceolate or oblong-spatulate, obtuse, remotely and minutely denticulate or subentire, narrowed to a short, often obscure petiole: scape exceeding the lvs. 4–14 in. high, bearing a many-fl. umbelliform head, sparsely farinose or not so below the infl.: bracts linear-lanceolate, acuminate, more or less auriculate: fls. rose, violet, or lilac with a whitish eye; calyx split two-thirds to three-fourths its length, the teeth lanceolate, rather obtuse or rarely rather acute, often colored at their apex; corolla-limb $\frac{1}{2}$ – $\frac{3}{4}$ in. across, with obcordate lobes: caps. ovate or rotundate, slightly exceeding the calyx or not. Mountains of Greece to Persia. B.M. 392. Gt. 1874, p. 225.

130. *capitellata*, Boiss. Lvs. farinose or becoming bald, ligulate-lanceolate or subspatulate, narrowed to

an often obscure petiole, obtuse or rather acute, obsolete and sparingly denticulate or subentire, rarely sharply denticulate: scape exceeding the lvs. or (in alpine forms) more or less equaling them, $1\frac{1}{2}$ –10 in. high, bearing a densely fld. subsessile head: bracts oblong-lanceolate, obtuse base produced below the place of insertion: fls. rose; calyx split one-third to one-half its length, with ovate, obtuse lobes which become black; corolla-limb less than $\frac{1}{4}$ in. across, with short obcordate lobes: caps. globose, about as long as the calyx. Persia and Afghanistan. G. 31:49.

AA. Fls. distinctly pedicellate (pedicels short in No. 139).

B. Lvs. distinctly petiolate, the blade usually gradually contracted at base, the petiole not winged.

C. Lf.-margin entire.

131. *involucrata*, Wall. (*P. Murròii*, Lindl. *P. Träutlii*, Wilson). Fig. 3189. Not farinose: lvs. leathery, becoming somewhat glaucous, ovate, oblong, or deltoid-orbicular, obtuse, very entire or obsolete and minutely denticulate, suddenly contracted to a petiole which exceeds the blade: scape much exceeding the lvs., 4–12 in. high, slender, bearing a 3–6 to many-fld. umbel: bracts linear, their base spurred with appendages: fls. white; calyx glabrous, tubular, 5-ribbed, with narrowly triangular subacute lobes; corolla-throat annulate, yellowish, the limb about $\frac{3}{4}$ in. across, lobes obcordate. Himalaya. F.S. 10:1023. Gt. 1863:394. G.C. III. 22:263 (reduced in Fig. 3189). Gn. 79, p. 197. R.H.S. 39:209.—Needs a moist position.



3189. *Primula involucrata*.
($\times \frac{1}{4}$)

132. *sibirica*, Jacq. Plant wholly green: lvs. pale green, membranaceous, glabrous, elliptic-orbicular or ovate, very entire or rarely with a tendency to be denticulate, suddenly contracted to a petiole which almost equals the blade: scape exceeding the lvs., 2–7 in. high, slender, bearing a lax, few-fld. umbel: bracts oblong, obtuse, their base appendaged-saccate: fls. lilac or pink; calyx glabrous, tubular, 5-ribbed, with short, rather obtuse lobes; corolla-throat naked, the limb about $\frac{1}{2}$ in. across or less, with obcordate deeply emarginate lobes: caps. cylindrical, exserted from the calyx.

Var. *integrifolia*, Pax (*P. integrifolia*, Eder. *P. sibirica* var. *kashmiriana*, Hook. f.), has fls. mostly smaller, the corolla-tube scarcely exceeding the calyx, and the corolla-lobes narrower. B.M. 6493. Var. *brevicalyx*, Trautv., has corolla-tube twice or more longer than calyx. Arctic and alpine regions of the northern hemisphere. B.M. 3167 (as *P. sibirica*); 3445 (as var. *integerrima*). G.C. III. 41:350 ("the small variety"). Gn. 78, p. 412. G. 37:247. G.M. 56:963.

133. *conspersa*, Hort. Veitch. Allied to *P. sibirica*: lvs. finely but variably serrate, about $1\frac{1}{2}$ in. long and $\frac{1}{2}$ in. broad, erect, firm in texture, not farinose, fls. rather more rosy: scape about 9 in. high, farinose, bearing an umbel about 12-fld.: fls. about $\frac{3}{4}$ in. across, pale lilac: later than *P. farinosa* and with taller scapes and larger fls. W. Kansu, China.

134. *tibetica*, Watt (*P. pumilio*, Pax). Not farinose, dwarf: lvs. leathery, glabrous, elliptical, acute or obtuse, very entire, contracted to a petiole which almost equals the blade: scape very short, $\frac{3}{4}$ in. (frequently less) high, bearing 1–5 fls.: bracts linear-oblong, their base hardly gibbous: fls. rose or blue; calyx tubular, 5-angled, with short-triangular obtuse lobes; corolla-throat annulate, the limb hardly $\frac{3}{4}$ in. across, with deeply obcordate lobes: caps. long-exserted, cylindrical. High mountains of Thibet.

CC. Lf.-margin more or less denticulate.

D. Involucral bracts scarcely gibbous at base.

135. *Knuthiana*, Pax. Farinose, not hairy: lvs. membranaceous, oblong-ovate or lanceolate, acute or obtuse, narrowed to a winged petiole which is distinguishable from the blade or scarcely so and is equal to or shorter than the blade, densely farinose below, denticulate: scape equaling or exceeding the lvs., 4–5 $\frac{1}{4}$ in. high bearing a many-fld. lax umbel: bracts broad subulate-acuminate from the base which is scarcely gibbous: fls. violet; calyx open-campanulate, split to the middle with triangular acute lobes; corolla-throat constricted, the limb about $\frac{1}{2}$ in. across, with obcordate deeply emarginate lobes: caps. globose, included in the calyx. China, in two or more forms. G.C. III. 51: suppl. May 25. G.M. 55:254. F.E. 33:975. R.H.S. 39:160.

136. *frondosa*, Janka. Farinose or entirely devoid of farina, not hairy: lvs. very thin-submembranaceous, the inner ones finally becoming elongated, cuneate-oblong or when obovate, obtuse, gradually narrowed to a petiole which equals or exceeds the blade, sharply denticulate or when mature wavy-crenulate, a little undulate: scape exceeding the lvs., $1\frac{1}{4}$ –4 in. high, bearing a many-fld. lax umbel: bracts small, linear-lanceolate, their base not saccate: fls. bright blue; calyx tubular-campanulate, with triangular acute lobes; corolla-limb almost $\frac{1}{2}$ in. across, with obcordate, bifid-emarginate lobes: caps. cylindrical, equaling or half longer than the calyx. Balkans. Gn. 71, p. 323; 72, p. 167; 76, p. 194. Gn.W. 25:529. G. 36:534. R.H.S. 39:97.—It has been stated that the plant in cult. under this name is not the plant of Janka, but this is probably an error (see Roy. Hort. Soc. 39, pp. 103, 178).

DD. Involucral bracts somewhat saccate at base.

137. *efarinosa*, Pax. Not farinose, very glabrous: lvs. membranaceous, $1\frac{1}{2}$ in. (more or less) long, oblong-ovate, obtuse, sharply erose-denticulate, narrowed into a winged petiole which equals or is shorter than the blade: scape exceeding the lvs., 5–7 in. high, bearing a lax, many-fld. umbel: bracts acuminate from a saccate base: fls. violet; calyx tubular-campanulate, not split to middle with shortly triangular, subobtuse lobes; corolla-tube not constricted at the throat, the limb about $\frac{1}{2}$ in. across, with narrowly obovate, deeply emarginate-bifid lobes: caps. globose, included in the calyx. Cent. China.

138. *dariatica*, Rupr. Plant farinose or not so, glabrous: lvs. $\frac{3}{4}$ –2 $\frac{1}{4}$ in. long, soft, obovate-lanceolate, oblong or spatulate, obtuse, sharp-denticulate or serrate, suddenly cuneate-attenuate to a petiole which is longer or shorter than the blade: scape equaling or exceeding the lvs., bearing a few- or many-fld. umbel: bracts linear, their base somewhat saccate: fls. rose; calyx subglobose, split to the middle, with oblong, subacute, greenish lobes; corolla-limb less than $\frac{1}{2}$ in. across, with obcordate, bifid lobes: caps. exceeding the calyx. Caucasus region. R.H.S. 39:176.

139. *elliptica*, Royle. Not farinose: lvs. small ($\frac{1}{2}$ – $\frac{3}{4}$ in. diam.), membranaceous, glabrous, glaucous beneath, orbicular to elliptic, obtuse, strongly dentate, petioled, with base dilate and vaginate: scape exceeding lvs., 4–5 in. tall, somewhat flexuose, bearing a 3–10-

fld. nodding umbel: bracts linear and obtuse, dilated and saccate at base, exceeding the short pedicels: fls. rose-colored; calyx campanulate-tubular, cut to the middle, the lobes triangular and somewhat obtuse; corolla exceeding calyx, the limb more than $\frac{1}{2}$ in. across, the lobes obcordate: caps. included in calyx. W. Himalaya, Thibet.

BB. *Lvs. scarcely distinctly petiolate, the base of blade short-attenuate, the petiole winged.*

c. *Fls. yellow.*

140. *lutèola*, Rupr. Not farinose, glabrous: lvs. membranaceous, long lanceolate-elliptic, obtuse, denticulate, gradually narrowed to a petiole which is very frequently scarcely distinguishable from the blade: scape exceeding the lvs., 4-6 in. high bearing a densely many-fld. umbel: bracts lanceolate acute, their base saccate-produced: fls. pale sulfur-yellow; calyx campanulate, split two-thirds its length, with lanceolate acute lobes; corolla-limb about $\frac{1}{2}$ in. across, with obcordate lobes. E. Caucasus regions. G.M. 58:264.

cc. *Fls. rose, lilac, or purplish.*

d. *Corolla-tube little if at all exceeding the calyx, or only twice or less as long.*

141. *rosea*, Royle. Fig. 3190. Tufted, with rhizome bearing somewhat lf.-like scales, plant 4-8 in. tall, glabrous, not mealy: lvs. many, oblong-obovate or oblanceolate, crenulate or small-toothed: fls. few to many in a rather loose head (each fl. distinctly stalked), rose-red, more or less drooping, the tube somewhat exceeding the long sharp calyx-teeth, the lobes obcordate. W. Himalaya. B.M. 6437. Gt. 1879:994. Gn. 16:12; 29, p. 382; 31, p. 597; 39, p. 417; 62, p. 82; 77, p. 193; 79, p. 161. G. 14:110. R.H.S. 39:208. G.C. II. 19:540. F.M. 1879:360. R.H. 1880:330.—One of the best of the alpine primulas. Var. *grandiflora*, Hort., has large fls. Gn. 50:372. *P. magnifica*, Hort., is a German seedling from *P. rosea* var. *grandiflora*: lvs. coarsely toothed, gray-white when full-grown. Intro. 1904.

142. *Ólgæ*, Regel. Glabrous, not farinose: lvs. about $\frac{1}{2}$ -1 in. long, obovate-oblong, obtuse, narrowed into broadly winged petiole, crenulate-denticulate: scape about 3 in. tall, exceeding the lvs., bearing a dense umbel of rose-lilac fls.: bracts lanceolate, acute, somewhat saccate at base: calyx green and purple-striped, the lobes lanceolate and acute; corolla-tube twice as long as calyx, the lobes obcordate and bifid. Turkestan.—Alpine garden; late spring and early summer.

143. *farinosa*, Linn. (*P. Warei*, Stein). Fig. 3191. Farinose at least when young: 4-8 in.: lvs. variable in size, glabrous, veiny, elliptic-lanceolate, obovate or ovate-rotundate, obtuse, frequently gradually narrowed to a petiole which is scarcely distinguishable from the blade, denticulate or subentire: scape exceeding the lvs. $\frac{1}{2}$ -12 in. high, sometimes slender, sometimes stout, bearing a rather dense or lax many-fld. umbel: bracts lanceolate, acute, their base slightly saccate: fls. lilac, blue, or becoming purple, the throat yellow; calyx urn-shaped, green, with oval or subtriangular obtuse or rarely subacute lobes; corolla-limb $\frac{1}{2}$ in. or less across, with obcordate deeply emarginate lobes: caps. subequaling or almost twice exceeding the calyx. Generally distributed in boreal and alpine regions of the northern hemisphere, in N. Amer., occurring in Maine, on Lake Superior, and in the mountains as far south as Colo. Gn. 29, p. 385; 62, p. 29; 63, p. 406 (var. *alba*); 70, p. 271; 78, p. 282. G.C. III. 40:193; 58:333 (reduced in Fig. 3191). G. 8:456. F.E. 15:674.—A widely variable species, with which Pax & Knuth unite *P. mistassinica* and others. The Rocky Mt. form has been separated by Rydberg as *P. americana*. It is difficult to find good dividing lines between the many geographical forms of this type, and one must combine

them all into *P. farinosa* or keep many of them separate as species. The above description of *P. farinosa* is the inclusive one. More narrowly defined, it may be characterized as follows: lvs. obovate-lanceolate, farinose beneath: fls. variable in color and breadth of lobes, but usually pale lilac with yellow center, umbellate; calyx oblong-ovate, with linear teeth; corolla-limb flat; corolla-lobes obcordate and rounded below, distant, as long as the tube: caps. twice as long as calyx.

144. *scôtica*, Hook. The form in the extreme north of Scotland, on sandy heaths: half as large as *P. farinosa*: lvs. obovate-lanceolate: fls. bluish purple with yellow center; calyx swollen, the teeth short-ovate and blunt; corolla-limb flat, the lobes broadly obcordate and about half the length of the tube: caps. scarcely exceeding the calyx.

145. *modèsta*, Biss. & Moore (*P. farinosa* subsp. *modèsta*, Pax). Treated as a subspecies of *P. farinosa* by Pax & Knuth: lvs. farinose, about $2\frac{1}{2}$ in. long and one-sixth as broad, spatulate, dentate-serrate: scape about 5 in. tall, 10-fld.: bracts setaceous: pedicels about 1 in. long: calyx campanulate. Japan. R.H.S. 39:180.

146. *davùrica*, Spreng. (*P. farinosa* subsp. *davùrica*, Pax). Small or tall, 2-12 in. or more: lvs. 1-3 in. or more long, less than $\frac{1}{2}$ in. wide, lanceolate or narrow-elliptic or narrow oblong-lanceolate, obtuse, nearly or quite devoid of farina, wing-petioled, very nearly or quite entire: fls. rose or lilac-rose, on filiform pedicels. Siberia, Mongolia, subarctic N. Amer.

147. *mistassinica*, Michx. (*P. farinosa* subsp. *mistassinica*, Pax. *P. pusilla*, Hook.). Plant small and slender, with only mere traces of mealiness if any: lvs. only $\frac{1}{2}$ in. long, stalked or not, spatulate or obovate, toothed or repand: scape about 6 in. tall, with few fls., the latter flesh-colored (rarely white) and shorter than



3190. *Primula rosea*. ($\times \frac{1}{2}$)

in *P. farinosa*. Arctic Amer., and south to N. New England, Cent. N. Y., Lake Superior, etc. B.M. 2973 (?), 3020.

148. *magellànica*, Lehm. (*P. farinosa* var. *magellànica*, Hook. f.). The south hemisphere representative, growing in S. Chile, Terra del Fuego, Patagonia: robust, 4-8 in. tall: lvs. farinose beneath, rhomb-elliptic, crenulate-denticulate: scape strong, exceeding the lvs.: fls. nearly capitate, flesh-colored or white; calyx-teeth subacute: seeds large and granulate.

149. *concinna*, Watt. Very small but very handsome species, the whole plant in the wild not more than 1 in. high and growing in cushion-like clumps: lvs. about $\frac{1}{2}$ in. long, oblanceolate, acute or obtuse, entire or crenulate, yellowish farinose beneath: scape very short, not exceeding the lvs., with a 2-5-fld. umbel: bracts short, linear-oblong: fls. rose-purple varying to white, with notched yellow corona, the corolla-tube equaling the calyx, the lobes obcordate. High Himalayas; a charming alpine. R.H.S. 39:208.

150. *cognata*, Duthie. Lvs. rosulate, $1\frac{1}{2}$ -3 in. long, obovate or spatulate, obtuse, narrowed into a winged petiole, crenate-dentate and ciliolate, farinose beneath and minutely puberulent above: scape about 9 in. high, farinose, bearing 6-12 pale violet-purple white-throated sweet-scented long-pedicelled erect or spreading fls.: bracts linear-lanceolate, ciliolate: calyx $\frac{1}{4}$ in. long, the tube prismatically angular, the lobes linear, obtuse, yellow-farinose; corolla-tube about twice exceeding calyx, the limb divided nearly to base, the lobes



3191. *Primula farinosa*. ($\times \frac{1}{4}$)

obovate or cuneate and deeply 2-lobed. Szechuan, W. China, 10,000-12,000 ft. altitude. Intro. 1906. G.C. III. 39:358. Gn. 69, p. 303.

DD. *Corolla-tube very long*.

151. *longiflora*, All. Farinose: lvs. oblong-obovate, rarely ovate, acute or obtuse, denticulate or subentire, gradually narrowed to a short, broad petiole which is scarcely distinguishable from the blade: scape stout, 4-12 in. high, rarely lower, bearing a many-fld. umbel: bracts acuminate from a broad base, frequently denticulate, base subsaccate: fls. violet, throat yellow; calyx often colored, angular, subtubular, the lobes lanceolate, acute or obtuse, very much shorter than the corolla-tube; corolla-limb about $\frac{3}{4}$ in. across; stamens always inserted on the corolla-throat: caps. cylindrical, more or less exceeding the calyx. Alps to S. E. Eu. Gt. 1878:937a. Gn. 62, p. 29. R.H.S. 39:96.

XV. CORDIFOLIAE.

Nearly or quite glabrous, the lvs. cordate at base and distinctly petioled: corolla funnelliform and caps. cylindrical: Himalaya.

152. *Gambeliæna*, Watt. The buds farinose: lvs. long-petioled, almost orbicular, about $\frac{3}{4}$ in. diam., membranaceous, base cordate, dentate; the petiole

longer than the blade: scape $4\frac{1}{2}$ in. high, exceeding the lvs., glabrous, bearing 2-7 fls.: bracts lanceolate, acute: fls. purple; calyx minutely puberulous, campanulate, split below the middle, with lanceolate acute lobes; corolla-tube broadened toward the ringless throat, the limb $\frac{3}{4}$ -1 in. across, with obcordate emarginate lobes. Sikkim-Himalaya. R.H.S. 39:192.

XVI. SREDINSKYA.

Like the *Cordifoliae*, but the corolla cylindrical: Caucasus region.

153. *grândis*, Trautv. Plant stout, tall, large-lvd., not farinose: lvs. about 6 in. long, 5 in. broad, chartaceous, wrinkled, ovate or triangular-ovate, base cordate or subcordate, irregularly twice-crenate, very lightly powdery-puberulent below; the petiole narrowly winged, exceeding the blade: scape stout, exceeding the lvs., bearing a many-fld. umbel: bracts short, lanceolate-linear, acuminate: fls. borne on filiform pendulous pedicels, pale yellow; calyx campanulate, 5-ribbed, cut one-third of length with triangular acute lobes; corolla-tube cylindrical, with erect oblong-linear, obtuse retuse lobes which have a broad sinus between them; style long-exserted: caps. cylindrical, exceeding the calyx. Caucasus. Gt. 1879:968.

XVII. TENELLA.

Small plants: lvs. somewhat coriaceous, narrowed to petiole: fls. 1-2 on the scape: caps. globose: Himalaya, China.

A. *Scape practically none*.

154. *muscoides*, Hook. f. Plant minute, densely caespitose, very glabrous, not farinose: lvs. spatulate or ovate-oblong, convex, sessile, apex subtruncate, narrowed toward the base, coarsely toothed toward the top, the broad midrib produced beyond the blade: scape none: bracts small, ovate: fls. sessile, subsolitary, 2-bracted; calyx split below the middle, cup-shaped, with triangular acute lobes; corolla-tube slender, cylindrical, the limb about $\frac{1}{4}$ in. across, with narrowly obcordate, emarginate lobes. Sikkim-Himalaya.

AA. *Scape about equaling or exceeding the lvs*.

155. *bélla*, Franch. Plant slender, caespitose, glabrous: lvs. from $\frac{1}{2}$ to about 1 in. long, including the petiole, which equals or exceeds the blade, white-farinose below, ovate or suborbicular, incise-lobed, the lobes narrow, linear, acute or mucronate, narrowed to a very narrowly winged petiole: scape exceeding the lvs., 1-2-3-fld.: bracts lanceolate, acute, entire or tridentate at the apex: fls. violet-purple; calyx open-campanulate, split to the middle, with deltoid-ovate, acute lobes sometimes tridentate at the apex; corolla-tube cylindrical, the limb densely white-hairy at the throat, $\frac{3}{4}$ -1 in. across, with obovate-cuneate lobes which are bilobulate below the middle: caps. oblong, small, included in the calyx. S. W. China. Intro. 1908. R.H.S. 39:165.

156. *yunnanensis*, Franch. Plant rather small, glabrous: lvs. $\frac{1}{2}$ in. or less long, including the petiole, which is shorter than the blade, obovate-oblong, narrowed to the winged petiole, frequently farinose below, crenulate: scape 3-4 times longer than the lvs., bearing 1-2 fls. on pedicels about $\frac{1}{4}$ in. long ("in pairs on long slender stalks"): bracts lanceolate, acute: fls. violet-purple; calyx open-campanulate, split to the middle, with deltoid-lanceolate lobes, spreading after flowering and displaying a mealy upper surface; corolla-tube slender, the limb $\frac{3}{4}$ -1 in. across, not very concave, with deeply bilobulate lobes: caps. ovoid, small, included in the calyx. Yunnan, China. Two recent species allied to this are *P. kichanensis*, and *P. umbrellæ*. Intro. 1908. R.H.S. 39:168.

157. *kichanensis*, Franch. (*P. Clementinae*, Forr.). Plant more or less covered with farina: lvs. spatulate, sharp-serrate, obtuse or nearly so: scape slender, exceeding the lvs., bearing a spreading-drooping umbel of several almost sessile lilac-purple fls.: calyx-lobes short. W. China. Intro. 1908. R.H.S. 39:165.

158. *umbrélla*, Forr. Farinose, with short scape: lvs. oblong-pointed and irregularly dentate: fls. 5 or 6, lilac-purple, deflexed; calyx-lobes long and pointed. Yunnan, China. Intro. 1908. R.H.S. 39:168.—“The bracts radiate from the top of the scape, each one forming a channel in which a pedicel, twice the length of the bract, lies.”

XVIII. PETIOLARES.

Lvs. in rosettes, glabrous, or nearly so and mostly narrowed to their insertion, dentate, the midrib wide: fls. large, pedicelled, umbelled, the scape mostly short, sometimes long: caps. globose: Himalaya, China.

159. *petiolaris*, Wall. Glabrous, with or without farina or meal: lvs. membranaceous, rugose, polymorphous, the petiole long or short, the blade oblong or roundish in outline and more or less irregularly erose-denticulate: scape short or even none, sometimes equaling or exceeding the lvs., bearing long-pedicelled white, rose or pale purple fls.: calyx tubular or narrowly tubular-campanulate, somewhat enlarging after flowering, the lobes narrow and acute; corolla exceeding calyx, funnellform, the limb about 1 in. across, the lobes obcordate and emarginate, crenate or dentate: caps. globose, included in the dilated calyx-tube. Himalaya.—Perhaps not in cult., although *P. Winteri*, by some regarded as a form of it, is in gardens.

160. *Winteri*, W. Wats. (*P. petiolaris* var. *pulverulenta*, Hook. f.). Whole plant yellowish or whitish farinose: lvs. obovate-spatulate and irregularly dentate, 4 in. long and 2 in. broad: fls. 20 or more in a crowded umbel on a short scape, pale purple with a yellow eye and a broad white ring surrounding it; corolla-tube 1 in. long; limb flat, $1\frac{1}{4}$ in. across, the lobes rounded and toothed. Himalaya. G.C. III. 49:130; 55:238. Gn. 75, p. 130; 76:206. G.M. 54:163; 58:200. G. 33:303; 34:607; 35:207; 36:206; 37:217. R.H.S. 39:185.

XIX. CANKRIENIA.

Lvs. nearly or quite glabrous, membranaceous or paper-like, serrulate or denticulate, narrowed to the petiole: fls. in superposed umbels: caps. globose: China; also Japan, Himalaya, Java, N. Amer.

A. Fls. yellow.

161. *imperialis*, Jungh. Tall, stout, not farinose, the infl. excepted, glabrous: lvs. 4–16 x $2\frac{1}{4}$ – $4\frac{1}{2}$ in., elongate-obovate or spatulate, obtuse, long-narrowed to a winged petiole which is shorter than or rarely equal to the blade, wrinkled, finely denticulate, the very broad midnerve produced beyond the blade: scape stout, much exceeding the lvs., 16–32 in. or more high, bearing several many-fld. superposed umbels which are 2–3 in. apart, more remote in fr.: bracts lanceolate from a broad base, acuminate: fls. golden yellow; calyx open-campanulate, farinose or not so, with short, broadly triangular acute lobes; corolla-tube slightly dilated toward the ringed throat, the limb about $\frac{3}{4}$ in. across, rarely less, with obcordate emarginate lobes: caps. globose, included in the calyx. Mountains of Java. B.M. 7217. Gn. 40:266; 61, p. 272. G.M. 34:758, 759.—Not hardy N. The noblest of cult. primulas, the scape rising $3\frac{1}{2}$ ft., and bearing 5 or 6 whorls of deep yellow fls. of firm substance. Once confounded with *P. prolifera*, from which it differs, according to Hooker, in “the more robust habit, the thicker texture, broader midrib, close reticulate nervation, and bullate surface of the foliage and its deeper colored flowers.”

162. *serratifolia*, Franch. Lvs. long-elliptic or oblong, sharply irregularly serrate, rugose above, broad at the end or only short-acute: scape slender, much exceeding the lvs., bearing a few fls. on short but slender drooping pedicels; corolla pale yellow with lemon-tinted blotch in center. S. W. China.—Apparently confused in the descriptions, the *P. serratifolia* of Pax's monograph being, according to Balfour, “a chimera including *P. Beesiana*, *P. pulverulenta*, and *P. serratifolia*,” Intro. 1908. R.H.S. 39:173.

163. *Bulleyana*, Forr. Plant $1\frac{1}{2}$ – $2\frac{1}{2}$ ft. tall: lvs. paper-like, ovate-lanceolate, rounded or acute at apex, narrowed into a short winged petiole, sharply irregularly toothed, glabrous and lightly hispid above: scape tall and strong, farinose at apex, bearing 5–7 superposed umbels each 15–17-fld.: bracts linear, farinose when young: fls. faintly fragrant, deep reddish orange, in bud deep brownish crimson, on spreading or drooping pedicels that are erect after anthesis; calyx campanulate or in fr. cup-like, the lobes triangular to subulate; corolla-tube cylindrical to funnellform, the limb nearly 1 in. across, the lobes obovate to roundish: caps. ovoid, scarcely exceeding calyx. Yunnan, China, 10,000–11,000 ft.—Named for A. K. Bulley, England, for whom Forrest collected in China. Intro. 1908. G.C. III. 46:16, 17. J.H. III. 68:103. R.H. 1911, p. 467. G.M. 52:403. G. 35:325. R.H.S. 39:172.—Produces heavy rosettes and fl.-sts. $2\frac{1}{2}$ ft. tall; a moisture-loving species, and apparently adapted to cultivation in this country.

164. *helodoxa*, Balf. f. A very recent addition to this group, collected in 1912 in China and intro. into Great Britain in 1913. It is described as a magnificent plant of strong growth, producing many whorls of dark yellow fls. Intro. 1913.

165. *Cockburniana*, Hemsl. Glabrous: lvs. membranaceous, 2–4 in. long, obovate-oblong, obtuse, the young ones more or less puberulent, soon becoming bare, obscurely lobed and at the same time minutely or obsoletely denticulate, narrowed toward the base but scarcely petiolate: scape slender, 4–18 in. high, bearing 2 superposed 3–6-fld. umbels: bracts minute: fls. yellow; calyx farinose, narrowly campanulate with deltoid acute lobes; corolla-tube cylindrical, the limb scarcely 1 in. across with obcordate spreading retuse lobes. W. China. Intro. 1906. B.M. 8073. G.C. III. 37:331; 40, 231, 249. R.H.S. 39:172. Useful for pots and also planted out. *P. “Unique,”* offered by Bees, in England, is a hybrid between *P. Cockburniana* and *P. pulverulenta*: fls. cinnabar-red, in tall graceful spikes (see No. 31).

AA. Fls. white, rose, or purple.

B. Scape pilose.

166. *sonchifolia*, Franch. (*P. grattissima*, Forr.). Lvs. papery, 6–8 in. long, glabrous, sprinkled with raised dots, oblong or obovate-oblong, obtuse, double-sinuate, the mature ones subtruncate, the teeth or lobes broadly triangular and acute and spreading or somewhat reflexed, sharply denticulate: scape about equaling the lvs., thick, the top as well as the pedicels and the calyx very shortly scabrous, bearing a simple umbel: bracts very short, ovate-triangular: fls. violet; calyx mealy or not, short-campanulate, cut scarcely one-third its length, with ovate, obtuse lobes; corolla-tube broadened toward the throat, the limb $\frac{1}{2}$ –1 in. or more across, slightly concave with obovate shortly emarginate lobes: caps. globose, included in the calyx. S. W. China. G.C. III. 47:58.

BB. Scape pulverulent or farinose.

167. *pulverulenta*, Duthie. Resembles *P. japonica* in general habit, but distinguished by its silvery-farinose scape and infl. and by the deep rose-purple or violet-colored fls., also by the long and gradually

acuminate calyx-lobes: rootstock short and stout: lvs. membranaceous, 6-16 in. long including petiole, obovate or oblanceolate, rounded at apex, tapering into long winged petiole, irregularly dentate and sometimes obscurely lobed: scape to 3 ft. high, silvery farinose as are also the calyx and the spreading pedicels: bracts linear: calyx not equaling corolla-tube, white-farinose inside, the lobes lanceolate and acuminate and valvate around the elliptic-oblong or subglobose caps. after flowering; corolla about 1 in. diam., with orange-brown eye, the limb deeply divided, the lobes obcordate. W. China, 8,000-10,000 ft. altitude. Intro. 1905. G.C. III. 41:391. R.H. 1911, p. 466. R.B. 36, p. 270. Gn.W. 25:516. G. 33:609; 35:415; 37:55. G.W. 13, p. 124. R.H.S. 39:169.—Thrives in usual garden conditions but best along streams and about ponds.

BBB. *Scape glabrous, or at most only puberulent.*

c. *Corolla-throat annulate.*

168. *japonica*, Gray. Plant glabrous, tall, not mealy except the calyx: lvs. 4-6 by about 2 in., obovate-oblong or spatulate, obtuse, membranaceous, sharply and irregularly denticulate, gradually narrowed to a winged petiole shorter than the blade and with a sheathing base: scape tall, much exceeding the lvs., 8-24 in. high, bearing several many-fld. superposed umbels: bracts linear-subulate: fls. purple, rarely rose or white; calyx open-campanulate, mealy inside, with broad-triangular acuminate lobes; corolla-tube gradually broadened toward the ringed throat, the limb about $\frac{3}{4}$ in. across, with obcordate emarginate lobes: caps. globose, shorter than the calyx. Japan. B.M. 5916. G.C. III. 33:307; 40:207. J.H. III. 68:465. G.M. 48:283. G.Z. 15:129. G.W. 3, p. 183. H.F. II. 13:265. Gt. 1872, p. 195. R.H. S. 39:193. F.S. 19:1950, 1951. I.H. 18:69. Gn. 29, p. 382. R.H. 1871:570; 1895, p. 424. F.M. 1871:537, 538; 1872:9.—Blooms early in summer to midsummer. Makes a noble plant in deep moist soil and a shaded place. Hardy at the N. There are many color-forms, as var. *alba*, Hort., has white fls. (Gn. 78, p. 280. G.W. 7, p. 559); var. *rosea*, Hort., has rose-colored fls. (F.W. 1872:257); var. *lilacina*, Hort., lilac; var. *splendens*, Hort., rich blood-red; var. *striata*, Hort., striped white; var. *salmonea*, Hort., salmon-colored; var. *bicolor*, Hort., white with crimson center; var. *carinata*, Hort., carmine.

169. *Beesia*, Forr. Very like *P. serratifolia* (No. 162), and at first confused with it: 1-2 ft. high: fls. rose-carmine with bright yellow eye, fragrant: lvs. oblong to obovate-oblong or ovate-lanceolate, obtuse or very short-acute at apex, narrowed to petiole which is winged above, serrate: scapes surpassing the lvs., bearing about 3 or more whorls of few to several more or less deflexed fls.: calyx campanulate, to 5 lines long; corolla-limb about $\frac{3}{4}$ in. across; spring and early summer. Yunnan, China, 9,000 ft. altitude. Named for Bees, nurseryman, Liverpool. Intro. 1908. G.C. III. 50:240, 243. J.H. III. 68:121. G. 36:175. R.H.S. 39:168.—A moisture-loving species. An attractive and promising species for cultivation.

170. *Poissonii*, Franch. Plant tall, stout, glabrous, not farinose or aromatic: lvs. about 8-9 in. long and 2 in. broad, stiff-leathery, glaucous, obovate-oblong, obtuse, sharp-dentate, margin folded upward on each side and crisped and twisted, midrib prominent; the petiole very short, sheathing and scarcely distinct from the blade: scape stout, many times longer than the lvs. (3-5 ft.), bearing superposed umbels of 3-12 fls.: bracts lanceolate, herbaceous: fls. rose; calyx split to the middle or below, tubular-campanulate, with ovate-lanceolate, subacute lobes; corolla-tube funnelform, red inside and out, puberulous inside, the limb with a golden ring at the mouth, about 1 in. across, flat on

expansion, with obcordate, emarginate and cleft lobes: caps. cylindric, little exposed above the closely investing tubular calyx, the fr.-stalks closely appressed to the scape. Yunnan, China. B.M. 7216. Gn. 62, p. 81. R.H.S. 39:169.—Fl.-stalks and calyx usually glistening and red-striate; season of bloom long. Intro. 1890. A very promising species.

171. *Wilsonii*, Dunn (*P. angustidens*, Pax, in part). Plant aromatic: lvs. green (not glaucous), tending to recurve rather than to incurve, rarely 8 in. long or more than $1\frac{1}{2}$ in. broad: fl.-stalk and calyx green, not shining: fl. much smaller than in *P. Poissonii*, the corolla-limb concave and never flat, the lobes short, rounded, crenulate, not cleft: caps. ovoid, much projecting from the cup-like calyx, the fr.-stalks not so closely appressed to the scape. China. Intro. 1907.

172. *oblanceolata*, Balf. f. (*P. angustidens*, Pax, in part). Plant like *P. Poissonii*: not aromatic: lvs. glaucous, oblanceolate or strap-shaped, always narrow (about 1 in. wide) and often more than 1 ft. long, flat, curving outward from the st., the margins with sharp and rigid small teeth: calyx not shining; corolla-limb larger than that of *P. Poissonii*, flat on expansion, tube whitish inside and outside, the lobes acute: fr. ovoid with conical summit, partially inclosed in calyx, the fr.-stalks not rigidly appressed. China.

173. *Miyabeana*, Ito & Kawak. (*P. japonica* var. *Miyabeana*, Ito). Lvs. oblong-ovate to wide-oblanceolate, acute when young but later obtuse or rounded, to 8 in. long, somewhat narrowed at base, glabrous on both surfaces, farinose beneath at first but becoming nearly or quite destitute of meal, the margin irregularly denticulate: scape 1-2 ft. high and much exceeding the lvs., bearing several superimposed, 6-10-fld. whorls, with pedicels to $1\frac{1}{2}$ in. long: bracts $\frac{1}{2}$ - $\frac{3}{4}$ in. long, narrow and acute: calyx mealy within, the lobes deltoid and shorter than the tube; corolla purple, the tube more than $\frac{1}{2}$ in. long, the obcordate lobes nearly $\frac{1}{4}$ in. long: caps. oblong or globose-oblong, inclosed in the purplish fruiting calyx. Formosa. B.M. 8606.—Closely allied to *P. Poissonii*.

cc. *Corolla-throat not annulate.*

174. *Párryi*, Gray. Plant glabrous or minutely puberulent, tall, robust, not farinose: lvs. more or less than 8 in. long, 1-2 in. broad, fleshy, narrowly obovate-oblong, obtuse or subacute and then mucronulate, entire or minutely denticulate, almost sessile, narrowed to a winged petiole which is scarcely distinguishable from the blade: scape tall, stout, 8-16 or 20 in. tall, bearing a simple 1-sided, many-fld. umbel: bracts oblong-lanceolate, acute: fls. fragrant, purplish; calyx glandular, split to the middle, the tube ovoid, with triangular acute often purplish lobes; corolla-tube broadened toward the ringless throat, the limb with a golden mouth, 1 in. across, with obcordate, emarginate lobes: caps. oblong, included in the calyx. Rocky Mts., Idaho and Colo. to Ariz. B.M. 6185. Gt. 1877, p. 65.—According to Nelson, "a handsome plant but very rank smelling; along subalpine brooks." Often 1 ft. and more high.

175. *Rúsyi*, Greene. Not farinose (except the infl.), slender and small for the section: lvs. 2-3 in. long, oblanceolate, subobtusely, membranaceous, denticulate, narrowed to the narrow winged petiole which more or less equals the blade: scape slender, $4\frac{1}{2}$ -6 in. high, slightly exceeding the lvs., bearing a simple 6-10-fld. umbel: bracts ovate-lanceolate: fls. bright rose borne on pedicels which are soon nodding; calyx tubular-campanulate, split almost to the middle, farinose, with narrowly lanceolate, acute lobes; corolla-tube slender-cylindrical, the limb somewhat concave, almost $\frac{3}{4}$ in. across, with obcordate emarginate lobes. Mountains in New Mex. and Ariz. B.M. 7032. G.C. III. 54:190. J.H. III. 51:89. Gn. 78, p. 388.

Lvs. glabrous or nearly so, nearly coriaceous, bluntly toothed: fls. in umbels, very nearly sessile or short-pedicelled: caps. globose: Turkestan to China.

A. *Calyx cut scarcely to the middle.*

176. *vittata*, Bur. & Franch. Glabrous: lvs. membranaceous, not farinose, narrowly oblong, obtuse or subobtuse, finely denticulate, narrowed to a short winged petiole which is scarcely distinguishable from the blade or even subsessile: scape 6–10 in. high, much exceeding the lvs., white-farinose at the top, bearing a simple umbel or 2 superposed and a short distance apart: bracts lanceolate, acute, white-farinose margined: fls. somewhat nodding, purple; calyx campanulate, not split to the middle, purplish green, the lobes triangular, subacute and glabrous; corolla-tube obconical-dilated above the calyx, the limb concave about $\frac{1}{2}$ in. across, with broadly obovate, subtruncate, slightly emarginate and at the same time frequently undulate-subcrenulate lobes. Cent. China. Intro. 1905. B.M. 8586. G.C. III. 37:390; 40:209. R.H.S. 39:161.—The calyx is banded or costate with white farina.

177. *brevifolia*, Forr. Glabrous and not farinose: lvs. paper-like, very broadly ovate-elliptic, serrate, attenuate into short winged petiole: scape slender, 4–8 in. high and much exceeding the lvs., bearing a 4–12-fl. unilateral somewhat drooping umbel: bracts small, broad-lanceolate, acute: fls. faintly fragrant, pedicellate, deep blue; calyx purplish green, with broad-lanceolate acute lobes; corolla broad-funnelform, the tube equaling or exceeding the calyx, the limb $\frac{1}{3}$ to nearly $\frac{1}{2}$ in. across, lobes short and broad and emarginate. S. E. Thibet, altitude 14,500–16,000 ft. G.C. III. 57:207.

AA. *Calyx cut to the middle or beyond.*

B. *Lobes of calyx acute.*

178. *hazárica*, Duthie. Lvs. obovate or spatulate, denticulate, membranaceous, densely white-farinose below, acute or obtuse, gradually narrowed to a short winged petiole which is scarcely distinguishable from the blade: scape only slightly exceeding the lvs., about 4 in. high bearing 1 to many fls., which are umbellate: bracts linear, somewhat recurved: fls. purple; calyx narrowly campanulate, split to the middle, with lanceolate, acute, ciliate lobes; corolla-tube cylindrical, pale yellow, the limb about $\frac{1}{2}$ in. across, with broadly or narrowly obcordate emarginate lobes: caps. included in the calyx. W. Himalaya.

179. *membranifolia*, Franch. (*P. longituba*, Forr.). Lvs. very thin-membranaceous almost diaphanous, cuneate-ovate from an entire base, unequally dentate-crenate, very glabrous, yellow-farinose below: scape scarcely equaling the lvs., bearing 4–9 fls.: bracts short, linear, these as well as the pedicels yellow-farinose: fls. violet; calyx yellow-farinose, split to the middle, tubular-campanulate, with lanceolate, acute lobes; corolla cylindrical, slender, gradually broadened to a concave limb which is $\frac{3}{4}$ –1 in. across, with obcordate, emarginate lobes: caps. ovate, slightly exceeding the calyx. S. W. China. Intro. 1908. R.H.S. 39:165.

BB. *Lobes of calyx obtuse.*

180. *calliantha*, Franch. Lvs. with petiole 2–3 in. long, oblong or obovate-oblong, attenuate into short winged petiole, yellowish farinose beneath, dentate-crenulate: scape about twice longer than lvs., the apex and the narrow-lanceolate bracts farinose, the umbel with 5–10 pedicelled fls.: calyx brown-purple outside and farinose within, narrow-campanulate, very deeply cut and with linear-oblong obtuse lobes; corolla deep purple-violet, the tube cylindrical and little if any exceeding the calyx, the limb about 1 in. across and cup-shaped, the lobes obovate and dentate. Yunnan, China. Intro. 1908.

Lvs. glabrous or nearly so, entire or nearly so, narrowed into a winged petiole: caps. cylindrical: Asia Minor to China and far north; N. Amer.

A. *Fls. yellow.*

181. *sikkiménsis*, Hook. Glabrous and devoid of farina, the calyx excepted, the scape reaching 2 ft.: lvs. 4–5 x 1–1½ in., narrowly obovate-spatulate, obtuse, wrinkled, sharply double-serrate, subequally narrowed to the petiole: scape elongated, 8–14 in. high, bearing a many-fl. umbel: bracts narrow, subulate-acuminate from a broad base: fls. slightly drooping, yellow; calyx farinose, 5-ribbed, tubular-campanulate, not split to the middle, with triangular acute frequently recurved lobes; corolla-tube funnelform-broadened, the limb concave, flattened up to 1 in. across, with roundish emarginate lobes: caps. subcylindrical, exceeding the calyx. Himalayas; reported also from China, but the oriental forms may be distinct. Two of them, also in cult., are Nos. 182 and 183. B.M. 4597. Gt. 1876, p. 321. Gn. 62, pp. 82, 113; 65, p. 93; 79, p. 161. J.H. III. 49:571. G. 4:589. G.M. 52:869. J.F. 2:169. R.H.S. 39:161.—*P. sikkimensis* is a fine alpine species from altitudes of 11,000 to 15,000 ft. and more, covering large areas with fragrant light yellow bloom; considered to be easy to grow along water-courses or in other moist places, but requiring shade.

182. *pseudosikkiménsis*, Forr. Differs from *P. sikkimensis* in having shorter lvs. and larger fls.: plant 12–18 in. high, with bright canary-yellow fragrant fls. Crevices and ledges of limestone cliffs, Lichiang Range, Yunnan, 11,000–12,000 ft. altitude. Intro. 1908. R.H.S. 39:161.

183. *microdonta*, Petitm. Very like *P. sikkimensis*, but distinguished by the suborbicular-ovate glabrescent lvs. with a petiole as long as the blade, irregularly toothed: corolla at least twice as large as calyx, deep yellow and attractively veined. W. China. Intro. 1912.

184. *orbiculáris*, Hemsl. Similar in foliage to *P. Cockburniana* and *P. tangutica*, but very different in fls.; most nearly allied to *P. sikkimensis* and *P. Stuartii*, from which it differs in having nearly entire lvs., tube of corolla, which scarcely exceeds calyx, constricted near the top and below the middle at the insertion of the very short stamens, and in the limb of the corolla which is flat and with entire lobes. Lvs. somewhat coriaceous, oblong-lanceolate, 2–3 in. long, obtuse, longitudinally recurved, minutely dentate: scape about 1 ft. high, yellowish or whitish farinose, bearing an umbel of 5–7 yellow fragrant pedicellate fls.: calyx thick, campanulate, scarcely $\frac{1}{2}$ in. long, the lobes ovate and obtuse and equaling the tube; corolla scarcely exceeding calyx-tube, the limb orbicular and about 1 in. diam., the lobes orbicular. W. China. Intro. 1906. B.M. 8135. G.C. III. 39:403.

185. *Stuartii*, Wall. An exceedingly variable Himalayan species with drooping yellow fls. in a terminal umbel: radical lvs. 5–10, narrowly oblanceolate, acute, sharp-serrate or sometimes entire, yellow, mealy beneath: scape 12–18 in. tall, bearing a mealy-covered infl.: fls. light yellow, with tube twice the length of the usually acute-lobed calyx, the lobes orbicular and emarginate or sometimes orbicular and entire. B.M. 4356. G.C. II. 19:824; 25:528. Gn. 29, p. 382.—Fls. 1 in. or more long.

186. *elongáta*, Watt. Glabrous: lvs. about 4 in. long, membranaceous, obovate, obtuse, crenulate, farinose or not so below, gradually narrowed to a short, winged petiole: scape almost twice as long as the lvs., 8–10 in. high, farinose above, bearing a somewhat congested umbel of 5–8 fls.: bracts triangular, acute: fls. golden yellow; calyx farinose, tubular, split to the middle, with lanceolate acute lobes; corolla-tube funnelform-broad-

ened, the limb concave, 1 in. across, with ovate, truncate, emarginate and crenulate lobes. Sikkim-Himalaya.

187. *szechuanica*, Pax. Glabrous and not farinose: lvs. 2-3 in. long, thin-membranaceous, oblong or ovate-oblong, suberose-denticulate, acute, narrowed to winged petiole: scape 8 in. or more high, stout, bearing an umbel of 6-10 yellow fls.: bracts triangular, acuminate: fls. nodding; calyx green, 5-ribbed, about $\frac{1}{2}$ in. long, tubular, incised about one-third of the way, the lobes ovate and subacute; corolla cylindrical, the limb nearly $\frac{1}{2}$ in. across, the ovate lobes reflexed. Szechuan, China.

AA. Fls. purple or violet, rarely white.

B. Corolla-lobes reflexed.

188. *Maximowiczii*, Regel. Glabrous, not farinose: lvs. distinctly petiolate or almost subsessile, narrowly elliptical or elliptic-oblong, acute, densely denticulate or subentire, base entire, petiole winged, equaling the blade, sheathing, spreading at the base, whitish, rarely almost none: scape many times longer than the lvs., 8-16 in. high, glabrous, not farinose, stout, bearing a simple numerous-fl. umbel or superposed umbels: bracts long-acuminate from a broad base: fls. dark purple; calyx campanulate, green, 5-ribbed, cut one-third the length, with triangular, very acute, somewhat recurved lobes; corolla-tube slender, cylindrical, the limb flattened, $\frac{1}{2}$ in. across, with reflexed oblong lobes, neither retuse nor emarginate: caps. frequently much exceeding the calyx. N. Cent. China. Intro. 1911. B.M. 8363. G.C. III. 47:221; 53:267. Gn. 77, p. 208. R.H.S. 39:152.

189. *tangutica*, Pax. Glabrous, not farinose: lvs. almost sessile, 2-3 in. long, oblong or ovate-oblong, acute, narrowed toward the base, very entire or slightly denticulate, the very broad, white midnerve produced beyond the blade: scape stout, 14-16 in. high, glabrous, bearing superposed umbels: bracts long-acuminate from a broad base: fls. 4-6 to an umbel, soon drooping, purple; calyx glaucescent, tubular-campanulate, cut one-third its length with triangular acute ciliate lobes; corolla-limb $\frac{3}{4}$ in. across, with narrow, linear lobes. N. China. Intro. 1906. B.M. 8043. G.C. III. 38:42.

BB. Corolla-lobes not reflexed.

190. *nivalis*, Pall. Glabrous, farinose or not so: lvs. 3-5 in. long, ovate-oblong or lanceolate, obtuse or subacute, margin often recurved, crenate-dentate or subentire, gradually narrowed to a winged petiole which is shorter than and very often scarcely distinguishable from the blade: scape robust, 3-10 in. high, exceeding the lvs., bearing a many-fl. umbel, rarely 2 superposed: bracts subulate-acuminate from a broad base: fls. erect, purple or white; calyx frequently farinose, cup-shaped, split below the middle, with lanceolate, acute or rather obtuse lobes; corolla-limb $\frac{1}{4}$ - $\frac{3}{4}$ in. across, with ovate, retuse lobes: caps. frequently twice the length of the calyx. Caucasus to the Himalayas and China, northward to the Baikal and Dahuria.—A variable species, with well-marked geographical forms. The white-fl. plant in cult. as *P. nivalis* is a form of *P. hirsuta* (No. 16).

191. *purpurea*, Royle (*P. nivalis* var. *purpurea*, Regel. *P. Sturtii* var. *purpurea*, Watt). Lvs. obovate-spatulate, nearly entire: fls. purple, in compact umbels: caps. often twice length of calyx. Thibet, etc., 10,000-14,000 ft., on exposed hillsides, but seeking the shade of overhanging banks. Gn. 31:444; 62, p. 131.—Correvoit describes it as a stout, strong-looking plant, with stiff upright slightly toothed lvs. (often untoothed), dark green above and bright white generally yellowish beneath, long and narrow: fls. very dark purple, numerous, drooping because of the length of the pedicel, which, with the st., is covered with white powder; corolla deeply cut: scape 8-12 in. high.

192. *turkestanica*, Regel (*P. nivalis* var. *farinosa*, Schrenk). Smaller: lvs. 2-3 in. long, and about 1 in. wide, elliptic-oblong, crenate-dentate or dentate or rarely nearly entire, densely farinose beneath and on the margins: fls. sometimes in superposed umbels; pedicels short; calyx and corolla purplish. Turkestan.

193. *sinopurpurea*, Balf. (*P. nivalis* var. *sinensis*, Pax). Said to be "a splendid species, enveloped in golden meal": robust: lvs. entire: fls. purple, on short pedicels, often in superposed umbels; calyx densely farinose inside and on margins of lobes. W. China.

194. *Purdomii*, Veitch. White-farinose: lvs. lanceolate or oblanceolate, 3-5 in. long and $\frac{3}{4}$ in. or less broad, tapering to the winged or wingless petiole: scape about 6-7 in. high, bearing a 3-12-fl. pendulous umbel of nearly sessile lilac-mauve (or bright violet) fragrant fls. with a small greenish yellow eye; corolla-tube almost closed, the limb about 1 in. across: caps. oblong, exserted. W. Kansu, China, altitude 10,000-11,000 ft. B.M. 8535. G.C. III. 53:200. Gn. 77, p. 170. G. 35:209. G.M. 56:201. R.H.S. 39:164.—Certificated by Roy. Hort. Soc., 1913. "Like most members of the *Nivalis* group of primulas, *P. Purdomii* died after flowering. It is a plant of vigorous growth and robust habit which prefers a loamy soil" (B.M.).

195. *pulchella*, Franch. Glabrous: lvs. 2-4 in. long, yellow-farinose below, narrowly lanceolate; acute or obtuse, revolute, minutely denticulate, long-narrowed toward the base: scape 8-12 in. high, stiff, bearing a many-fl. umbel: bracts lanceolate or linear: fls. erect, violet; calyx golden farinose finally bare, split below the middle, with lanceolate acute not at all rarely unequal lobes; corolla-limb $\frac{3}{4}$ in. across, with shortly lobulate, sometimes entire lobes: caps. ovate, obtuse, more or less equaling the calyx. S. W. China. Intro. 1908. G.M. 56:962. R.H.S. 39:161.

196. *pulchelloides*, Ward. A smaller plant than *P. pulchella*, with fewer and smaller fls., less depth of color and also narrower smaller lvs. China. Intro. 1911. R.H.S. 39:164.

197. *Cusickiana*, Gray. Scapes 6 in. or less tall, each bearing 2-4 violet or white fls.: lvs. oblong-spatulate or narrow-oblong, about 2 in. long, entire or very nearly so: involucre-bracts 2 or 3, conspicuous, unequal: corolla-lobes retuse, the tube little if any exceeding the green calyx-lobes which are white striate between. Early spring. E. Ore.—Offered by dealers in native plants.

198. *secundiflora*, Franch. Glabrous: lvs. 2-4 in. long, papery, golden farinose below when young, finally becoming bare, oblong or ovate-oblong, finely and evenly serrulate, acute, narrowed to a winged petiole which is scarcely distinguishable from and equaling or shorter than the blade: scape exceeding the lvs., 8 in. or more high, stout, bearing a 1-sided, 6-10-fl. umbel: bracts triangular, acuminate: pedicels soon nodding, second: fls. bright violet; calyx dark purple, marked with 5 white lines, ovate-campanulate, split to the middle, with deltoid, lanceolate, acute lobes; corolla-tube cylindrical, the limb funnelform, $\frac{3}{4}$ in. across, with broadly obovate scarcely emarginate lobes. S. W. China. Intro. 1908. G.C. III. 55:357. Gn. 78, p. 284. R.H.S. 39:160.

XXII. MACROCARPÆ.

Lvs. glabrous or nearly so, contracted into a petiole and cuneate or rounded at base, toward the apex usually toothed: caps. cylindrical or ovoid: China, Japan, N. Amer.

199. *Fatiriei*, Franch. Lvs. distinctly petioled, sulfur-farinose below, $\frac{3}{4}$ -2 in. long, membranaceous, ovate or oblong-ovate, obtuse, crenulate-dentate or almost subentire, gradually narrowed to a wingless or narrowly winged petiole: scape more or less exceeding the lvs., 2-4 in. high, bearing a several- to many-fl.

umbel: bracts linear-subulate: fls. rose; calyx narrowly campanulate, split nearly to the middle, with lanceolate acute lobes; corolla-tube cylindrical, the limb flat, and about $\frac{1}{2}$ in. across, with triangular-obcordate, deeply emarginate lobes, the lobules divaricate: caps. cylindrical, much exceeding the calyx. Japan.

200. *suffrutescens*, Gray. Rhizomatous, part above ground branched and woody: plant not farinose, glabrous: lvs. about 1 in. long including the petiole, cuneate-spatulate, obtuse, leathery, top 5-7-toothed, long-narrowed toward the base to a winged petiole which is scarcely distinguishable from the blade: scape 4-5 in. high, bearing a many-fl'd. umbel: bracts lanceolate, acuminate: fls. reddish purple; calyx campanulate, split almost to the middle, glandular-puberulent, with lanceolate, acute lobes; corolla-tube pale, gradually broadened toward the throat, the limb $\frac{1}{2}$ - $\frac{3}{4}$ in. across, with obcordate, emarginate lobes. Calif.; alpine. R.H.S. 39:181.

L. H. B.

PRINGLEA (personal name). *Cruciferae*. Perennial herb with a long stout rhizome and forming a head of lvs., in which it resembles *Brassica oleracea*: scape thick, simple, with a strict fr.-bearing raceme: fr. a 1-celled siliqua. One species from Kerguelen Land. *P. antiscorbutica*, Hook. f. KERGUELEN'S LAND CABBAGE. Lvs. broadly obovate-spatulate, 3-6 in. long: peduncle arising from the rhizome, beneath the foliage, 2-3 ft. long, leafy, bearing a dense raceme 6-12 in. long: sepals oblong; petals none: fr. shortly oblong or oblong-lanceolate. R.H. 1913, p. 14. Intro. into botanic gardens abroad. Valuable as a remedy for scurvy.

PRINOS: *Illex*.

PRINSEPIA (after Macaire-Prinsep, botanist at Geneva, Switzerland). Including *Plagiospermum*. *Rosaceae*, subfamily *Pruneeae*. Woody plants, chiefly grown for their early-appearing flowers and bright green dense foliage.

Deciduous shrubs: branches with axillary spines: pith lamellate: lvs. alternate, petioled, entire or serrulate; stipules small, lanceolate: fls. 1-4 in the axils of last year's branches or in axillary racemes; calyx with cup-shaped tube and broad and short lobes imbricate in bud; petals 5, spreading, suborbicular, clawed; stamens 10 or many, with short filaments; ovary superior, 1-celled, the style inserted near the base, with capitate stigma; ovules 2: fr. a drupe with a smooth or slightly fissured stone.—Three species on the Himalayas and in N. E. Asia to N. W. China. The edible frs. are gathered in their native countries.

The two prinsepias in cultivation are low spiny slender-branched shrubs with narrow bright green foliage and white or yellow flowers appearing with the leaves in early spring along the branches of the previous year and followed by purple or black cherry-like drupes which, however, so far have been produced only sparingly in cultivation; possibly the flowers, though apparently perfect, are functionally dioecious or they need insects for fertilization, which are wanting at the very early flowering time of this shrub. The shrubs have proved perfectly hardy at the Arnold Arboretum, only the flowers suffer sometimes during cold weather; they are among the earliest shrubs to burst into leaf and are conspicuous by their bright green foliage when most other shrubs are still bare. They seem to grow best in a sunny and open position and in well-drained soil. Propagation is by seeds sown after maturity or stratified and sown in spring or by greenwood cuttings under glass; also by layers.

sinensis, Oliver (*Plagiospermum sinense*, Oliver). Fig. 3192. Shrub, to 6 ft. or taller, nearly glabrous: younger branches light gray, older brown, with short axillary spines about $\frac{1}{4}$ in. long: lvs. slender-petioled, ovate-lanceolate to lanceolate, long-acuminate, cuneate

at the base, sometimes broadly so, entire or sometimes sparingly serrulate, finely ciliate, otherwise glabrous, bright green above, paler beneath, 2-3 in. long: fls. 1-4, on pedicels about $\frac{1}{2}$ in. long, bright yellow, $\frac{1}{2}$ - $\frac{3}{4}$ in. across; sepals triangular ovate; stamens 10: fr. subglobose or ovoid, $\frac{1}{2}$ - $\frac{3}{4}$ in. across, purple, juicy; stone ovoid, compressed, rugose. April, May. N. E. Asia. M. D. 1903:1. I.T. 5:182. H.I. 16:1526. R.H. 1907, pp. 418, 419.—Besides being an ornamental shrub this species may be worth while growing for its cherry-like edible frs. which have a pleasant acid taste.

uniflora, Batalin. Shrub, to 4 ft., with slender spreading light gray branches: spines about $\frac{1}{4}$ in. long: lvs. short-petioled, linear-oblong to narrow-oblong, acutish or obtuse at the apex, cuneate at the base, entire or remotely serrulate, dark green above, paler beneath, glabrous, 1-2 in. long: fls. 1-3, on pedicels about $\frac{1}{2}$ in. long, white, $\frac{1}{2}$ - $\frac{3}{4}$ in. across; stamens 10: fr. about $\frac{1}{2}$ in. across, black, with bloom; stone ovoid, compressed, rugose, about $\frac{1}{2}$ in. long. April, May. N. W. China.—This and the preceding species are closely related and form a distinct subgenus chiefly characterized by fascicled fls. with only 10 stamens, while *P. utilis* has the fls. in axillary racemes and many stamens.

3192. *Prinsepia sinensis*. (X $\frac{1}{4}$)

P. utilis, Royle. Shrub, to 5 ft.: spines 1-1 $\frac{1}{4}$ in. long, usually leafy: lvs. elliptic to oblong-lanceolate, acuminate, entire or serrulate, 1 $\frac{1}{4}$ -4 in. long: fls. pedicelled, in axillary racemes, white, about $\frac{1}{2}$ in. across: fr. purple, $\frac{1}{2}$ - $\frac{3}{4}$ in. across, edible. Himalayas.—Apparently not in cult. in this country and probably not hardy north of Washington, D. C.

ALFRED REHDER.

PRIONIUM (Greek *saw*, referring to the leaves, which have serrate edges). *Juncaceae*. Tender aquatics growing in great masses in running water.

Stem erect, woody, from a repent rhizome: perianth rigid, cleft to the base, segms. ovate, subequal; stamens 6; ovary sessile, globose, 3-celled; ovules usually few, often 2 in a cell: caps. rigid, 3-valved; seeds usually only 1 to a cell.—One species in S. Afr. This is one of the few plants of the rush family having the lvs. crowded at the top of an erect woody st. 5-6 ft. high. This plant may be grown in a pot placed in a pan of water, and, if desired, may be planted out for the summer in a wet position. Prop. by division.

Palmita, E. Mey. St. stout, often forked, 2-4 in. in thickness, reaching a length of 5-6 ft.: lvs. linear, rigid, glabrous, 3-4 ft. long, in a dense rosette at summit of st.: infl. a large, dense, terminal panicle on long peduncle; perianth and bracts $\frac{1}{2}$ in. long. B.M. 5722. G.W. 11, p. 390.

F. TRACY HUBBARD.†

PRITCHARDIA (W. T. Pritchard, British consul at Fiji in 1860). *Palmaceae*, tribe *Corypheae*. Spineless fan palms from islands of the South Pacific; also in Cuba if *Colpotherinx* is included.

Trunk usually ringed, crowned at the summit by a large cluster of spreading plicate-flabelliform lvs.: spadix at first erect, ultimately drooping at the fruiting stage: fls. hermaphrodite, small, green; ovary 3-cornered or 3-lobed, narrowed into a strong style; corolla with persistent tube and deciduous segms.; embryo subbasilar.—About 14 or 15 species; by some, Washing-

tonia is included in this genus. The genus was monographed by Beccari in *Malasia*, vol. 3 (1890). A good horticultural account is that of Wm. Watson in *G.C.* III. 13:332 (1893). True pritchardias, according to Watson, differ from all other fan-lvd. palms in the form of the blade, which is cuneate in outline; the lvs. are also exceptionally soft and pliant. The best of the genus, probably, is *P. pacifica*, which is remarkable for its fibrous fluffy lf.-stalks.



3193. *Pritchardia pacifica*.

A. Ovary 1, 3-angled or 3-lobed, attenuate into style.

B. Fr. black-purple, globose, 6 lines thick.

pacifica, Seem & Wendl. Fig. 3193 (adapted from Martius). Trunk attaining 30 ft. high, 10-12 in. thick, straight, smooth: lvs. $4\frac{1}{2}$ ft. long, $3\frac{1}{4}$ ft. wide, densely covered when young with whitish brown tomentum, finally glabrous and of a fine rich green; segms. about 90; petiole $3\frac{1}{3}$ ft. long. Samoa, Fiji Isls. I. H. 21:161. F.S. 22:2262.

BB. Fr. yellow or red, 9 lines thick.

Gaudichaudii, Wendl. (*P. macrocarpa*, Lind.). Trunk 20 ft. high, 1 ft. thick, usually much lower in cult.: lvs. roundish, 3-4 ft. long, covered beneath with pale brown matted wool, slit for about 1 ft. into about 60 segms.; petioles 2-3 ft. long, without spines; calyx glabrous and not prominently striate: fr. ovoid, $\frac{3}{4}$ in. long, yellowish red. Hawaiian Isls. I. H. 26:352.

BBB. Fr. greenish, globose, 15-20 lines thick.

Martii, Wendl. Trunk generally not exceeding 5-6 ft., but recorded to 12 ft., as thick as in *P. Gaudichaudii*: lvs. glabrous and glaucous below, not woolly; segms. about 40, not as deep; petioles longer: calyx densely striate: fr. globose, $1\frac{1}{4}$ - $1\frac{3}{4}$ in. diam., greenish. Hawaiian Isls.—Cult. in S. Calif.

AA. Ovary of distinct carpels. (*Colpothrinax*.)

Wrightii, Becc. (*Colpothrinax Wrightii*, Wendl.). BARREL or BOTTLE PALM. PALMA BARRIGONA. Fig. 3194; also Fig. 2725, p. 2437. Formerly retained in *Colpothrinax*, as the only species, but recently (1907) transferred to *Pritchardia* by Beccari: st. single, rising for 3-6 ft. or more, at first cylindrical but gradually increasing in thickness in a bottle-like or flask-like form, the trunk slender and ascending beyond this part till the whole reaches 30-40 ft.: lvs. circular in outline, more than 5 ft. across, suborbicular, flabellate-radiate, regularly divided into about 80 segms. about $4\frac{1}{4}$ ft. long; segms. rigid, slightly leathery, pale green, very glabrous and shining: spadix simply duplicate-branched; spathes 2, slightly leathery, red-brown: fls. sessile: fr. globose, 1-celled. Sandy savannas in Pinar del Rio, Cuba.—A very striking palm is indicated in Fig. 3194, which is drawn from photo-illustration in *Pomona College Journ. Ec. Bot.*, vol. 3.

P. borneensis, Hort., was intro. in 1891 by Linden, but unknown to botanists.—*P. filamentosa*, Hort., is presumably a catalogue error for *P. filifera*.—*P. filifera*, Lind., is *Washingtonia filifera*.—*P. grandis*, Bull. is *Licuala grandis*.—*P. periculdrum*,

Wendl. is characterised by its dark brownish golden petioles and obliquely spherical fr. Pomotu Isl.—*P. robusta*, Hort., listed abroad, is without botanical description.—*P. Thirstonii*, Drude, is distinguished by its long slender fl.-stalks like fishing-rods bearing a thyrs-like infl. Neither of the last two is in cult. in Amer.

L. H. B.†

PRIVET: *Ligustrum*. P., Mock: *Phillyrea*.

PROBOSCIDEA: *Martynia*.

PROCHNYANTHES (Greek, *kneeling and flower*; referring to the sudden bend in the flower which is likened to a knee). *Amarylhidaceæ*. Interesting tuber-bearing plants, probably suitable for cult. in pots and also planted out: closely related to *Polyanthes* and *Bravoa*, differing chiefly in the shape of the flowers.

Sts. slender, from oblong tubers which crown short thick rootstock: lvs. mostly basal: infl. a lax spike or raceme: fls. always in pairs, tubular below, abruptly bent at the middle, bell-shaped above; stamens 6, included: fr. 3-celled, many-seeded.—A genus, discovered by E. Palmer in 1886, of which two species have been described. Native of W. Mex.

viridescens, Wats. Sts. 4-6 ft. high: lvs. mostly basal, numerous, 1-2 ft. long, 2-3 in. broad, erect: fls. 5-30 pairs, brownish; pedicels nearly wanting to $1\frac{1}{2}$ in. long. At first supposed to be a very rare species, known only from near Guadalajara, Mex., but found by the writer to be very common in the mountains of the states of Jalisco, Durango, and Zacatecas. Not yet in the trade, but it is a plant that deserves to be intro.

P. Bulliána, Baker. Hardly differs from the above but described as having larger fls., which are sessile instead of having a long pedicel: fls. brownish green. The fls. are not jointed at the pedicel as Baker says. B.M. 7427.—*P. viridiflora*, mentioned under B.M. 7427, is a mere slip of the pen for *P. viridescens*.

J. N. ROSE.

PROMENÆA (named presumably after the prophetess of Dodona). *Orchidaceæ*. A group of small herbs with the habit of *odontoglossum* but having leaves of paler green.

Leaves conduplicate in the bud: pseudobulbs evident: infl. originating above the annual leafy axis, 1-2-fld.; sepals and petals subequal, spreading, the lateral sepals forming a mentum with base of the column; labellum movably joined to the base of the column.—About 10 species in Brazil. It is one of the many genera formerly united with *Zygopetalum*. For cult. see *Zygopetalum*.

xanthina, Lindl. (*Zygopetalum xanthinum*, Reichb. *P. citrina*, Donn). A little orchid with small ovate pseudobulbs and lanceolate lvs. 2-3 in. long: fls. pale lemon-yellow; labellum



3194. *Pritchardia* (or *Colpothrinax*) *Wrightii*, from Cuba. Swelling is usually higher on trunk.

3-lobed, with crimson spots in the throat; column streaked with red. June. Brazil. G.W. 14, p. 521.

graminea, Lindl. Lvs. about 6 in. long, lanceolate, faintly striate, jointed to the equitant bases: scapes 3-5, clustered; fls. dirty yellow, spotted with brown; sepals and petals oblong-lanceolate; labellum oval, crisp and toothed on the margin, shaded with rose and blotched with crimson-brown. Spring. Brazil. B.M. 5046. G.C. II. 23:636.—On account of the absence of pseudobulbs this species is now generally placed in the genus *Keffersteinia*.

stapelioides, Lindl. Pseudobulbs 4-angled, 1-2-lvd.: lvs. lanceolate, pale glaucous, reticulate; peduncle 2-fld.; fls. green outside, yellowish inside, speckled and banded purple. Brazil. B.R. 25:17 (as *Maxillaria*).

P. microptera, Reichb. f. Fls. $1\frac{1}{2}$ in. broad; sepals and petals lanceolate, acute, light green; lip 3-lobed, basal half white with narrow purple bars, front lobe green; column pale green. Brazil. —*P. Rollissonii*, Lindl. Fls. pale yellow, the lip with purple spots; sepals and petals very acute; lip with lateral lobes ovate, acute, the front lobe oblong, apiculate. Brazil. G. 12:237; 17:103.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

PROPAGATION: Cuttings, Grafting, Layers, Nursery, Seeds, and Seedage.

PROSARTES: *Disporum*.

PROSÔPIS (Greek, but the meaning is obscure). *Leguminosæ*. Tender trees and shrubs, including the mesquit and the screw bean, two forage plants of considerable value in the arid regions of southern California and the Southwest.

Stems with or without spines, the spines axillary, solitary or in pairs or only the stipules spinescent: lvs. bipinnate, 1 or 2 pairs of pinnae; lfts. usually numerous, small, entire: fls. small, greenish, in cylindrical or globose axillary spikes: pods linear, coriaceous and indehiscent.—About 25 species, tropical and subtropical regions of the world.

The mesquits are thorny shrubs which ordinarily grow only a few feet high in the desert, but under favorable circumstances make trees 60 feet high. They are also called algaroba and cashaw. The sweetish pods are eaten chiefly by cattle. Seeds and plants are offered in southern California.

A. Plant spiny: pod straight or sickle-shaped.

juliflora, DC., and allies. MESQUIT, or Mesquite. Several forms have been confused under this name. *P. juliflora*, DC., is a strictly W. Indian species, with many pairs of lfts. very close together, $\frac{1}{4}$ – $\frac{3}{4}$ x $\frac{1}{8}$ – $\frac{1}{4}$ in. rather thin in texture and elliptic to oblong, apex and base blunt and rounded. *P. dulcis*, Kunth, is a Mexican species somewhat similar to the preceding but with the lfts. slightly more distant although still crowded, $\frac{1}{4}$ – $\frac{1}{2}$ x $\frac{1}{8}$ in., linear to linear-oblong, apex tending to be acutish and mucronulate, the texture more coriaceous. *P. glandulosa*, Torr., is the common species throughout Texas, New Mex., and S. Calif., also occurring in Mex.; it has more remote pairs of lfts. often distantly so, $\frac{3}{4}$ –2 x $\frac{1}{8}$ – $\frac{1}{4}$ in., which, when mature, are longer than in *P. juliflora*, rigid and linear, those of the young shoots frequently elliptical to spatulate and up to $\frac{1}{4}$ in. or even more broad, base slightly narrowed, apex mucronulate and usually acutish although also bluntish. *P. velutina*, Wooton, is a southwestern species which looks much like *P. dulcis*, but the younger shoots, lvs., and lf.-rachis velutinous-pubescent; lfts. $\frac{1}{4}$ – $\frac{1}{2}$ x $\frac{1}{8}$ – $\frac{1}{4}$ in. oblong, apex rounded, base rounded. Ariz. and S. Calif.

AA. Plant less spiny: pod spirally twisted.

pubescens, Benth. (*Strombocarpa pubescens*, Gray). SCREW BEAN. TORNILLO. Shrub or small tree, merely spinescent on petioles: lfts. 5-8 pairs, oblong, $\frac{1}{4}$ – $\frac{1}{2}$ in.

long: spikes globose to cylindrical, $1\frac{1}{2}$ –2 in. long: pod twisted, nearly sessile, 1-2 in. long. Texas, Calif., Mex.—The pods are used as food by Mexicans and Indians.

P. strombulifera, Benth. (*Acacia strombulifera*, Willd.), is a shrub 5-8 ft. high, with ash-gray bark, very short spines, lfts. of the pinnae 4-6-paired, linear, and the pod yellowish, about 2 in. long, and spirally twisted. Peru. F. TRACY HUBBARD.†

PROSTANTHERA (Greek, *to add to*, and *anther*; referring to the connectives of the anthers being spurred or crested beneath). *Labiatæ*. Shrubs or subshrubs with resinous glands, and commonly strong-scented.

False whorls 2-fld., axillary or borne in a terminal raceme; fls. often white or red; calyx campanulate, limb 2-lipped; corolla-tube short, dilated into a broad campanulate throat; limb 2-lipped; stamens 4, in pairs; anthers 2-celled, connective dorsally slightly prominent, often spurred or appendaged: nutlets obovoid and netted wrinkly.—About 40 species from Austral. Prop. by cuttings of young shoots.

nivea, A. Cunn. A beautiful shrub, 3-6 ft. high, glabrous except the corolla or with a few appressed hairs: st. and branches slender, twiggy, upper ones 4-angled: lvs. $\frac{1}{2}$ – $1\frac{1}{2}$ in. long, oblong-lanceolate or linear, entire, pale green; margins involute, especially on older lvs.:



3195. *Protea cynaroides*. (× $\frac{1}{10}$)

fls. snow-white or tinged with blue; pedicels short; calyx about $\frac{1}{4}$ in. long, green; corolla $\frac{1}{2}$ – $\frac{3}{4}$ in. across. Rocky hills, New S. Wales and Victoria. B.M. 5658.—Can be safely grown only where the lemon is hardy. It is a showy species when well grown.

Other species which have been intro. and sometimes cult. abroad are: *P. denticulata*, R. Br. Robust shrub: lvs. sessile or nearly so, broadly lanceolate to narrow-linear, with rigid bristles on the margins: fls. in distant pairs forming interrupted terminal racemes, lilac to purple. B.M. 7934.—*P. pulchella*, Skan. Subshrub about $1\frac{1}{2}$ ft. high, slender: lvs. subsessile, linear to linear-lanceolate: fls. with a lilac subrotate corolla, the tube white at base, dotted with dark purple at the throat. B.M. 8379.—*P. rotundifolia*, R. Br. Shrub, 3-7 ft. high: lvs. broadly ovate, orbicular or spatulate, entire or coarse crenulate: fls. in short close terminal racemes, purple. G.M. 58:147.

F. TRACY HUBBARD.†

PRÔTEA (from Proteus, the sea-god, who changed into many forms; alluding to the baffling diversity of the species). *Proteaceæ*. Tender shrubs, small trees or acaulescent perennial plants, which are among the most attractive and characteristic plants of the Cape of Good Hope, a region whose plant life is singular.

Leaves alternate, coriaceous, entire: fls. in many-fld. sessile or subsessile, terminal or lateral, usually solitary heads, inclosed in an involucre of numerous imbricate coriaceous to scabrous and various colored bracts; ovary covered with long hairs; ovule 1: nut

densely bearded.—About 100 species, mainly from S. Afr. but extending into Trop. Afr. Their fl.-heads are said to look like a "glorified artichoke." Indeed *P. cynaroides* (Fig. 3195) is named from this very resemblance. (*Cynaroides* means cynara-like; and *Cynara* is the artichoke.) It has bright pink fl.-heads which last several months. The structure of the fl.-heads is the distinctive feature of the whole family of the Proteaceae. The showy parts of the fl.-head are the bracts, which are often rigid, colored, and overlap one another like the scales of a hard cone or an artichoke. "When the heads of *P. cynaroides* first open," says Watson, "they are full of honey and are known to the Boers as honey-pots." This honey is collected and made into a kind of sugar. The blooming of the "honey-pots" is a great occasion for picnics. Watson saw large bushes of *P. speciosa* at the Cape, which he declared were quite as effective as big specimen rhododendrons. "Fifty years ago," writes Watson, in 1891, "there were about 30 species of Protea included among popular greenhouse plants in England; now one may safely say there is not one; the few really under cultivation being only in botanical collections." In 1881, Hooker wrote: "That these and many other plants requiring like treatment will be reintroduced, and will be the wonders of the shows for many successive seasons, is as certain as that they were once the glories of the old flue-heated houses that our forefathers called stoves, in which orchids quickly perished, and Banksias and Proteas thrived magnificently." Over 40 colored plates of proteas have been published, of which 23 appeared in Andrews' Bot. Rep. between 1797 and 1811.

The interest in proteaceous plants is growing in southern California. Proteads have a reputation for being difficult to cultivate away from the Cape, but Hooker's statement seems to indicate that their culture is not so much difficult as special. Under glass they are said to require a coolhouse which is airy and sunny. "The one great danger to cultivated Proteads," says Watson, "is excessive watering, and to guard against this it is found to be a good plan, in the case of delicate species, to place the pot in which the plant is growing inside a larger one, filling up the space between with silver sand. The latter is always kept moist." It is suggested by one grower that it is possibly not excessive watering that injures them, but insufficient drainage. Many of the species need staking, as the shoots are quick to break off at the base if unsupported. Proteas ripen seeds freely, and seeds can be easily procured from the Cape.

cynaroides, Linn. Fig. 3195. Bush, up to 6 ft. high or sometimes acaulescent: lvs. petioled, varying from subrotundate and obtuse to elliptic and acute: head sessile; outer involucre bracts ovate to ovate-lanceolate, inner lanceolate, oblong, acuminate, tomentose, exceeding the fls.; ovary oblong, covered with long whitish hairs. S. Afr. G.F. 8:35. G.C. III. 17:773. G.M. 38:407.

mellifera, Thunb. A large bush, 6-8 ft. high: lvs. linear-oblancoate: involucre bracts very viscid, those of the stipes silky pubescent, the others glabrous, dark red to whitish green with pinkish tips and margins but usually rosy pink: fls. whitish, exceeded by the involucre; ovary covered with long golden hairs. S. Afr. B.M. 346. R.H. 1903:308.—The oldest specific name for this plant is *P. repens*, Linn. Mant., not Thunb., but following Phillips & Stapf in Fl. Cap. 5 sect. 1:577, the name *mellifera* is maintained. They state that "The specific name *repens* is so inapplicable to this plant, while Thunberg's name is so suitable and has been in such general use that we have retained it." Var. *rubra*, Hort., is a form of *P. mellifera* which has been offered in the trade abroad.

nana, Thunb. (*P. rosacea*, Linn.). Smooth shrub, 2 ft. high, branched: lvs. acicular, erect-spreading, acute

or acuminate: involucre scales oblong, obtuse, the outer greenish, the inner scarlet, exceeding the yellowish fls. S. Afr. B.M. 7095. G.F. 4:413. G.M. 35:268, 269. Good horticultural accounts of proteas are those of Wm. Watson in G.F. 8:34 and 4:412, which have been liberally quoted above.

WILHELM MILLER.

F. TRACY HUBBARD.†

PROTECTION, as used by the gardener, is an indefinite term. A plant may need protection from living agencies, as animals, birds, insects, or plants (including fungi and weeds), or it may need protection from the weather,—heat, cold, rain, drought. Generally, however, the gardener means winter-protection, which again covers two very distinct ideas,—freezing injury and mere mechanical injury. Most Cape bulbs, for example, are ruined if they are frozen; tulips are not. Yet Cape bulbs may sometimes be wintered outdoors if they are protected by a covering heavy enough to keep out frost. Strawberries, on the contrary, are covered after frost with a light mulch, which is designed merely to keep the plants from being heaved by alternate freezing and thawing. These are the main objects of winter protection in the East, at least with herbs. In the prairie states the fruit-trees also need protection from the hot drying winds of summer and from sunscald, which are not the important considerations with eastern fruit-growers. See *Winter Protection*. Allied topics are discussed under *Greenhouse*, *Coldframes*, and *Hotbeds*; *Diseases and Insects*; *Weeds*; *Transplanting*.

PRÔTIUM (probably the Javan name). *Bursæra*. Trees, with balsam sap: lvs. toward the ends of the branches, alternate, 3-foliate or uneven pinnate; lfts. few-paired, rather large, petiolulate, entire or dentate: panicles long-peduncled, fasciculate, branched: fls. small, slender-pedicelled; calyx small, cup-shaped, 4-6-cleft or -dentate; petals 4-6, linear-oblong; disk urn-shaped; stamens 8-12; ovary sessile, 2-4-celled: drupe fleshy, globose.—About 50 species, mostly natives of Trop. S. Amer., some species also in India, Malaya, Mauritius, Madagascar, W. Indies, and Mex. *P. serratum*, Engl. (*Bursæra serrata*, Wall.). Sometimes planted in tropics and subtropics for ornament, and wood said to be used for furniture: evergreen: lfts. about 7 or more, opposite, narrow-ovate, base acuminate, pubescent or nearly glabrous, serrulate or entire: panicles axillary, lax, much branched, shorter than the lvs.: fls. very small, hermaphrodite, pubescent externally; calyx 5-toothed; petals 5; stamens 10: drupe globose, 1-3-celled. India.

PROTOPLASM. The living or organized cell-content. The difference between living and non-living things, so far as it has been possible to study it, consists in the fact that the former are characterized by the possession of protoplasm, "the physical basis of life." This protoplasm is a most complex material, the seat of diverse chemical reactions and physical changes, and at the same time a material having a wonderful capacity for correlation and growth. When the cell or living organism is killed, there is no loss of substance, and the material originally constituting this protoplasm remains, but there is left relatively little to suggest living protoplasm. So far as is known, this non-living residue can never be reëndowed or activated with those characteristic properties of correlation and growth, and many other properties less complex, which are the potential or kinetic possessions of the living. It is in some ways unfortunate to call the dead material by the same name as the living.

In the living plant or animal, the protoplasmic unit is the cell, usually microscopic in size, and an association of cells of the same form, or with similar functions, constitutes a tissue. The spores of many fungi and of mosses and ferns are single cells. In plants the protoplasmic unit is usually surrounded by a resistant mem-

brane, or cell-wall, resulting in a high degree of rigidity and strength. In some cases, as in "woody" tissues, the cells become highly modified, the walls may be much thickened, and the protoplasm may disappear, leaving only the non-living cell-walls.

Since the protoplasm is the seat of the greater part of the chemical reactions and physical changes even in the more complex living plants, with it must be associated the absorption, digestion, and assimilation of foods, respiration, and excretion, as well as growth, reproduction, and heredity capacities. In the simplest plants, such as many of the lower algæ (pond-scums), consisting of but a single cell, this cell must perform all the functions of the organism; but in complex plants there is a certain amount of differentiation of labor or function of the various protoplasts, or cell units. Thus the various tissues are more or less seats of different physiological processes; for example, the nectar-glands are "organs" of excretion, the green tissues are the seats of organic food-making (see *Photosynthesis*).

The protoplasm of the cell is itself differentiated into various structures, important among which are (1) the cytoplasm, or general protoplasm, within which are (2) the nucleus, and (3) the plastids (in green plants).



3196. Prunes.—California prune on the left (*Imperiale Epineuse*); common commercial on the right. (\times nearly $\frac{1}{2}$)

Protoplasm is generally regarded as a viscid semi-fluid material, and commonly it behaves as a liquid (an emulsion colloid). When killed, protoplasm is "set," that is, it becomes a jelly-like matrix, and it is a study of such fixed material upon which have been based the earlier views regarding structure. There is strong evidence that much of what is called the finer structure of protoplasm is a result of fixation, and that there is actually little real "structure" in the living material, although certainly the gross appearance may change more or less with the diverse activities of the cell. Protoplasm cannot be expressed chemically; indeed, the view which is today most widely accepted is that it consists of numerous substances physically related, rather than of complex molecules of a definite "substance."

B. M. DUGGAR.

PRUMNÓPITYS: *Polocarpus*.

PRUNE (from *Prunus*), is used in this country to designate a cured dried plum, and also the varieties that are employed for the making of this product. In literature, however, it may be used rather indefinitely for many kinds of plums, particularly those that are firm-fleshed; "dried prunes" is then used for the cured product which in this country is known only as "prunes." The product is now an important article of horticulture and commerce in California and the Pacific Northwest. It is also produced in southern and to some extent in central Europe.

Prunes in California.

There are at least three important characters which distinguish the prune interest of California from that of any other state, viz.: the extent of the industry, the method of curing, and the plum variety chiefly used.

According to figures gathered by George P. Weldon,

there were in California 91,470 acres of bearing prune trees in 1915, and 24,774 acres of young trees. This places the prune next to the peach, which is the leading deciduous tree-fruit of California with a total acreage of 144,888. The annual cured prune product of California, during the decade 1905 to 1914, has ranged from 57,000,000 pounds in 1908 to 205,000,000 pounds in 1912, the average annual product being 122,050,000 pounds. The Pacific Coast States produce all the prunes grown in the United States, and, according to the United States Census of 1910, "California reported, in 1909, 85.7 per cent of the total value of dried prunes produced in the United States." The development of this American product has not only reduced importation of European prunes so that they no longer receive distinctive enumeration in the customs reports, but about half the product is annually exported.

There are several reasons why the prune product of California is so overwhelmingly large and is still increasing. Beyond the general suitability of natural conditions for fruit-growing, there is, in the case of plum varieties, the total absence of the curculio, and "black-knot," the practical freedom from rot-fungi which attack ripening fruits, and a dry condition of soil-surface and air during August and September which favor gathering fruits from the ground and curing in the open air. Curing in evaporators by artificial heat is practically unknown. The process of handling prunes, from the tree to the package, is outlined by an experienced handler, E. N. Richmond, of San José, as follows:

"Prunes should never be picked from the tree. They should be allowed thoroughly to ripen and fall to the ground. An orchard should be covered by pickers every seven to ten days—seven days preferably, so as to prevent sunburn of the fruit lying on the ground. The usual form of contract with pickers calls for four pickings, no shaking of the trees until the third picking, and then at grower's discretion.

"The green fruit is hauled to the dipper-shed in picking-boxes and there passed through a light solution of lye. A kettle or tank, holding 200 gallons of water and containing a basket container, is used for this purpose. In many instances the fruit is rinsed by passing from this dip into a vat of clear water and then dumped onto a combination pricking-board and grader, operated by power, which grades the fruit into three grades so that the drying in the field can be uniform. The fruit is then placed on trays 8 by 3 feet and taken to the drying-yard and dried in the sun. The purpose of passing the fruit through the lye-solution and over the pricking-board is that the skin may be slightly cut, thereby hastening evaporation, preventing fermentation and producing a fruit with a clear bright meat. From the dipper-shed to the dry-yard, the fruit is hauled on a one-horse truck especially constructed for this purpose.

"The operation of drying requires judgment. Fruit should be allowed to lie in the sun on the trays until about three-quarters dried, and then the trays are stacked in piles, one above the other, leaving air-vents on either end. About twenty trays can be stacked in one pile and the finishing process takes place in this stack. Under normal weather conditions it takes from ten days to two weeks to cure prunes. While the fruit is on the trays in the dry-yard, it should receive at least one turning by hand, shaking the trays or using brooms, so that the fruit secures an equal drying on all sides. It also materially lessens the time of drying and makes a finer grade of fruit. The fruit must not be taken from the trays until it is thoroughly cured.

"At the packing-house the fruit is carefully separated

into the different grades, varying from thirty to forty prunes to the pound, up to prunes running smaller than 120 to the pound. The grades as to weight and size are obtained by passing the fruit over a large grader which consists of a series of screens of different sizes, commencing with the smaller size and increasing to just a trifle larger size every 3 or 4 feet. There are from eight to nine different screens, the largest fruit passing over the end. As the fruit comes from the grader, it is carefully tested by weighing and counting, and taken to the proper bin. From there it is taken as required for packing to the processor or cleanser. The fruit in the field has been subjected to considerable dust and dirt as well as insect life. The processor or cleanser conveys the fruit through a long vat of boiling-hot water, thoroughly washing and cleansing it. From the processor the fruit is dumped on a long shaker which further assists in the cleansing process, so that by the time the fruit is put into the boxes it is in a most sanitary condition. Prunes are packed in packages varying from one pound to fifty-five pounds according to the requirements of the trade for which they are intended."

The third distinctive feature of California prune-growing is the predominance of the Prune d'Agen—the variety which has been chiefly used in the commercial prune industry of France from early times. This variety (which is discussed in the article on *Plum*) has the "prune character" developed to a degree which no other plum variety has thus far attained. It has a sweetness often reaching above 50 per cent of fruit-sugars in the cured fruit, but this is not its distinctive character. The really distinctive characters are: (1) the high aromatic flavor in the cured fruit; (2) the dense fine texture of the flesh, which gives this variety unequalled tenderness and mouthful quality, both as a confection and as a slightly cooked fruit; and (3) the smallness, thinness and smoothness of the pit, which the tongue gratefully accepts. The chief objection to the variety is that, when grown without thinning and the tree is allowed to carry too much bearing wood, the fruit will be small. For this reason there has been a demand for the last fifty years for a prune retaining all the characters of the Prune d'Agen and adding greater size. Although continued effort has been made to find such a prune elsewhere in the world and to originate such a one in this state, this end has not yet been reached. All rivals of the predominant variety are, when dried, either flat or acid in flavor, coarse and stringy in flesh and large and rough in pit. It is quite probable that California growers are repeating the experience of the early French growers who have given us the Prune d'Agen as the result of their prolonged selection. Leonard Coates, of Morgan Hill, has emphasized the fact that there are variations toward better size among established trees of the true characters of the Prune d'Agen and propagation from such variations is being pursued. In view of long experience of disappointment in importation and origination, this seems at present the most promising avenue toward gaining size without losing other characters. The varieties which have been brought to notice as substitutes for the French prune have been planted only on a small acreage, have sold well for size and style and may continue to be profitable, although they can never satisfy habitual prune-eaters, for the reasons stated.

The culture of the prune tree as pursued in California has already been outlined in the article on the plum.

E. J. WICKSON.

Prunes in the Pacific Northwest.

Prune-culture in the Pacific Northwest has had a very checkered career. The early pomologist took much interest in plums and prunes, because of the magnificence of the products secured, and the ease with which they were grown. This interest increased

up to the early nineties, when the prune reached a boom period. Thousands of acres were planted in a few years. They were planted on all soils and exposures and a great many varieties were tried. Toward the latter part of the nineties, there was a tremendous production of the fruit, mostly of a questionable value. Few men knew how to evaporate prunes properly. Much of the product decayed in transit, while other portions were evaporated so hard as to be practically inedible. There was little or no market for the dried tart prune; consequently, there was but one inevitable result: namely, a collapse, and in a few years thousands of acres of trees were taken out. The United States Census shows that there were nearly a million less prune trees in the state of Oregon in 1910 than were growing in 1900. About 1905 the industry began to pick up. Those growers who had good locations and proper varieties, and who had mastered the process of evaporation, began to find a market. This market has steadily improved, until in the last seven or eight years the prune has proved to be a very profitable crop, either shipped green, or evaporated. The increase in acreage in the past four years has been very large, and the industry now seems to be thoroughly established. The United States Census for 1910, giving the number of plum and prune trees, shows the following figures:

Oregon.....	1,764,896
Washington.....	823,082
Idaho.....	302,855

The number of bushels produced is as follows:

Oregon.....	1,747,587
Washington.....	1,032,077
Idaho.....	179,027

There are two distinct areas in which the prunes of the Northwest are produced. In western Oregon and Washington, prunes are grown entirely for evaporation, the conditions there being strong loamy soils and abundant rainfall. East of the mountains the prunes are grown very largely in the irrigated valleys, although some of the dry-farming areas are producing a splendid fruit. The product at present, however, is largely centralized in such valleys as the Boise and Payette valleys of Idaho, the Grande Ronde and Freewater districts of Oregon, and the Walla Walla and Yakima valleys of Washington. In these districts the prunes are rarely evaporated, but are shipped out in the fresh condition to eastern markets, where they are generally known as plums.

There is considerable controversy, especially in the western section, as to the better locations for prunes. Some growers prefer the bottom lands—either the sandy loams along the rivers, or the stronger clay soils. The contention is that these lower elevations produce larger prunes and a greater yield. Another set of growers, however, stoutly maintain that the rolling hills are the only places for prunes, and while their plums are smaller, nevertheless they are heavier and sweeter, and their orchards are more reliable. East of the mountains, the prunes are generally planted in the silt loams.

Since all plum trees blossom in early spring, they are very subject to loss from frosts and cold rains. To offset the loss from frosts, the southern and eastern exposures should be avoided, as these are undesirable since the thawing out on such exposures is very rapid, supposed to lead to a breakdown of the tissues.

When planted on the lighter loams, the peach root is preferred, but when on the stronger loams, plum roots are better. As yet, not enough investigation has been conducted to determine what species of plum roots are the most desirable for the various locations.

On the lighter soils, or higher elevations, the trees are planted from 18 to 20 feet apart, but when grown on the stronger loams, from 20 to 22 feet should be allowed.

Some growers think that on extremely rich soils, 25 feet is a more desirable distance.

The tillage given prunes is very similar to that for other deciduous fruits grown in the Northwest. In all young orchards, the tillage should be very thorough in the early spring. With trees not in bearing, tillage should cease by the middle of July. In many of the bearing orchards, where the tillage has been very thorough in the early spring months, sufficient vigor of tree and size of fruit is often obtained so that tillage may be discontinued by the middle of July or the first of August, but in many of the orchards it will be necessary to continue the tillage up to about the time of harvest, which comes later, varying from the first of August to the middle of September.

Formerly, the trees were all headed from 30 to 40 inches in height. In more recent years, however, many growers are heading from 20 to 24 inches and producing very satisfactory trees. The same general principles that apply to the pruning of apple trees, also apply to the prune. Care should be taken to have the main scaffold limbs spaced as far apart as possible. Strong heading back is necessary the first few years. With many orchards, summer pruning can be conducted advantageously, the pruning being done largely in June and consisting of a cutting back of the terminals to the point where it is desirable to force out new laterals. Occasionally a little thinning out of the laterals is practised. When the trees reach their heavy bearing, which is about the seventh year, it is desirable to give them moderate pruning annually, the aim being to keep the trees well supplied with strong one- and two-year-old wood, as the large plums are found almost invariably on the vigorous wood. When orchards have been allowed to run down somewhat, it is often found desirable to thin out the spurs with hand shears, and in this way reinvigorate the remaining spurs. When trees are very much run down, the most satisfactory treatment will probably be to dehorn them, forcing out a new vigorous top which, in three to four years, will produce commercial crops of fruit. Very little hand-thinning is done with plums and prunes in the Pacific Northwest. The Italian prunes generally thin themselves. Some varieties of plums, however, must have hand-thinning.

Very little work has been done as yet with manures or fertilizers. Commercial fertilizers, where tried, have never given striking results in the older orchards. The growers are finding that, in mature orchards, a stable compost is very desirable. When it is impossible to secure such material, vetch or rye planted the latter part of August or early September, and plowed under in the early spring, is very beneficial. Care has to be taken, however, not to use excessive amounts of nitrogen, as this element tends to make the trees unproductive, and generally makes the skin of the prune so heavy that it is difficult to evaporate.

The prune industry in the Pacific Northwest is not old enough as yet to demonstrate how long an orchard will remain profitable. However, there are several orchards in Oregon forty years old, that are still very productive. On the other hand, there are orchards twenty years of age that have passed their usefulness. The trees in this latter class, however, have been neglected. Where good soil is obtained, and proper care given, it is safe to say that the orchards will be productive at least fifty years.

There are a number of insects which are troublesome to the prune. The San José scale attacks the tree, but is very easily controlled with the lime-sulfur spray. The borers—both the peach-root (*Sanninoidea opalescens*) and the shot-hole (*Xyleborus dispar*)—are very bad.

Young trees are often severely attacked with aphids. Other insects which are more or less troublesome at times are the leaf syneta (*Syneta albida*), the Indian meal moth (*Plodia interpunctella*), the rose-leaf hopper (*Empoia rosæ*), and the tipulid (*Ctenophora angustipennis*). Of the other diseases, the mushroom root-rot (*Armillaria mellea*) is very serious, especially when the trees have been planted on newly cleared land. Brown-rot (*Sclerotinia fructigena*) is the worst pest of the fruit and is becoming more serious. Other diseases that have to be contended with are crown-gall, rust, and bacterial canker. The latter three diseases, however, are not nearly so serious as the first two mentioned.

Of the varieties of prunes that are grown in Oregon, the Italian (Fellenberg) comprises about seven-eighths of the planting, and the percentage in favor of the Italian is constantly increasing. For evaporation, it is the only one worth consideration in the Northwest. For shipping purposes, however, numerous plantings have been made of the Tragedy, and also of the Hungarian. Other varieties that are grown to a limited extent are the French, locally called the Petite, or Prune d'Agen, the Pacific, Willamette, Clairac Mammoth, Columbia, Tennant, Silver, and Sugar. There is, of course, to be found scattered over the Northwest a



3197. A prune orchard in Oregon, with the fruit on the ground ready for harvest.

miscellaneous list of soft plums that are grown largely as local fruit. Since the Italian prune is benefited by growing with other varieties, there will probably always be a scattering of other kinds planted in our orchards. Many growers report that, wherever the Italians are near other varieties, a more satisfactory set of fruit is obtained on the Italian. In the evaporated fruit districts, the Petite will be the pollinator. The greatest drawback of this prune is its small size. It, however, dries heavier than the Italian and, size for size, sells somewhat higher.

When prunes are to be shipped in their green state for eating fresh in the eastern markets, it is customary to pick the fruit while it is still very hard and green. The plums, however, will have developed to a very large extent their true color before the packing is undertaken. The fruits are graded carefully and packed in five-pound baskets, four baskets being placed in a crate. While this crate virtually holds about twenty pounds, the weight of the fruit will range from eighteen to thirty pounds, according to varieties, size, and the general condition of the fruit. These four-basket carriers are the typical ones used for plums, apricots, and vinifera grapes constantly seen in the eastern markets. The fruit, when properly refrigerated, has not only been shipped all over the United States, but successful shipments have also been made to Europe, Mexico,

and Alaska. When the fruit is to be evaporated, it is first allowed to ripen on the trees and should not be gathered until it drops naturally to the ground (Fig. 3197), or will drop with very little shaking. The fruit is picked from the ground in bushel boxes, the pickers going through the orchard every few days to gather it up. The yield varies tremendously, from 1,000 to 8,000 pounds to the acre. As soon as the fruit is gathered, it should be hauled to the evaporators and evaporated quickly in order to avoid brown-rot, which often spreads rapidly in the containers.

There are two main types of evaporators used for drying fruit,—steam and hot air. The steam driers are used only where a very large output is obtained. It is customary for most of the orchardists to dry their own fruit. Since the orchards on the whole are rather small, an inexpensive building is used for the process, and the hot-air type of building is erected. These hot-air driers are of two distinct types, the tunnel, and the stack. There are many forms of tunnel driers. These tunnels consist of groups of long nearly horizontal pipeways, built over a fire pit. They vary in length from 25 to 50 feet. Each tunnel in itself may

also be provided. These should be in below the vent pipes so as to furnish fresh air rather than to assist in rapidly sucking out the warm air. There is a very close relation between ventilation, air-circulation, and the humidity of the atmosphere. Such relationship, unfortunately, has not been well studied by the larger number of those operating the evaporators.

The temperature is gradually increased during the drying process, starting in the neighborhood of 125° to 135° and finishing at 160° to 180°. It requires about thirty-six hours on the average to dry prunes well, the time depending on the building, ripeness of the fruit, and atmospheric conditions. The fruit will generally produce about twenty pounds of dried fruit to a bushel of fresh. Before the prunes are placed over the heat, it is customary to wash and grade the fruit. The more modern buildings now have automatic machinery which does all of this labor in one process. The prunes, after being sorted, are dipped into boiling lye. This is generally at the strength of one pound of lye to thirty to fifty gallons of water. This use of lye is adopted solely for the purpose of checking the skin of the fruit so that the gases can escape more readily and the prune

BULK BASIS	2	2 1/2	2 3/4	2 5/8	2 7/8	2 9/8	2 11/8	2 13/8	2 15/8	2 17/8	3	3 1/8	3 1/4	3 1/5	3 1/6	3 1/7	3 1/8	4	4 1/8	4 1/4	4 1/5	4 1/6	4 1/7	4 1/8	4 1/9	4 1/10	4 1/11	4 1/12	5
30 to 35.....	4 3/4	4 5/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	6 1/8	6 1/4	6 1/5	6 1/6	6 1/7	6 1/8	6 1/9	6 1/10	6 1/11	6 1/12	7
35 to 40.....	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	6 1/8	6 1/4	6 1/5	6 1/6	6 1/7	6 1/8	6 1/9	6 1/10	7
40 to 45.....	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	6 1/8	6 1/4	6 1/5	6 1/6	6 1/7	6 1/8	7
45 to 50.....	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	6 1/8	6 1/4	6 1/5	6 1/6	7
50 to 55.....	3 3/4	3 7/8	3 5/4	3 7/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	6 1/8	6 1/4	7
55 to 60.....	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	5 1/12	6	7
60 to 65.....	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	5 1/10	5 1/11	6
65 to 70.....	2 1/4	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	5 1/8	5 1/9	6
70 to 75.....	2 1/4	2 5/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	5 1/6	5 1/7	6
75 to 80.....	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	5 1/4	5 1/5	6
80 to 85.....	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5	5 1/8	6
85 to 90.....	1 1/4	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5
90 to 95.....	1 1/4	1 5/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	5
95 to 100.....	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	4 1/4	4 3/8	5
100 and over.....	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8	4	4 1/8	5

done, but very little is now practised in the Pacific Northwest.

The finished product is subject to considerable loss from fermentation, mold, and the attack of mites. It will be necessary for considerable scientific investigation to be made before the problems connected with these losses will be entirely understood. As soon as the prunes have been processed, they are taken in the hot, warm condition and packed in boxes. These boxes range in capacity from ten to fifty pounds. The bottom of the box is faced. Uniform, well-proportioned prunes are flattened with the fingers. This makes a very attractive top for the box when it is reversed. Lace paper and lithographs are used on the better packs.

In selling prunes, they are bought entirely according to weight, but based on the number of prunes to the pound: such as 30-40's, 40-50's, and so on, indicating the number of prunes to the pound. The table on page 2816 illustrates the method used in basing the prices for any given size of prune in the Pacific States.

The figures below the words "bulk basis," such as 30 to 35, 70 to 75, mean the number of prunes in a pound of fruit. The figures to the right of the words, "bulk basis," such as 2, $2\frac{1}{4}$, refer to the so-called base price paid for prunes. The base price is, in this case, figured on the sizes running from 75 to 80 prunes to the pound. Note that the figures to the right of 75 to 80 are the same as the figures to the right of the words "bulk basis."

As an illustration of the way the table works, take the first figure to the right of the words "bulk basis," which is 2. That means then, that for prunes running from 75 to 80 to the pound, the buyer will pay 2 cents a pound. Should the prunes be so large, however, as to run 30 to 35 to the pound, note that the figure to the right of this number is $4\frac{1}{4}$. Should they run, for example, 55 to 60 to the pound, note that the figure opposite is 3.

Should the base price at any time be more than 5 cents, one could easily enlarge this table by adding $2\frac{1}{4}$ cents to the base price for prunes running from 30 to 35 to the pound, and decrease the price $\frac{1}{4}$ cent for each smaller size in proportion to the size of the prunes.

C. I. LEWIS.

PRUNÉLLA: *Brunella*.

PRUNING is the methodical removal of parts of a plant with the object to improve it in some respect for the purposes of the cultivator. Much of the current "pruning" is really repairing, and is now commonly called "tree surgery." See page 354, Vol. I.

Under this denomination are comprised a multitude of practices and ideals. It is impossible to give any advice for pruning until one has analyzed the subject and knows the objects for which one is to work and the underlying principles on which the practices must rest. The larger part of the writing on pruning gives mere advice or directions, or details some person's experience, without analyzing or clarifying the subject. The practice must differ with every person and every condition, but the principles are general. The ideas that are associated with pruning may be grouped around three centers: (1) pruning proper, or the removal of a part of a plant for the purpose of bettering the product and improving the character of the remaining part; (2) training, or the disposition or placing of the individual branches, a practice that ordinarily is coincident with pruning proper; (3) trimming, or the shaping of a plant into some definite or arbitrary form.

The principles that underlie pruning proper may be associated with two purposes,—the lessening of the struggle for existence amongst the parts of a plant, and the cutting away of certain parts for the purpose of producing some definite effect in the formation of fruit-buds or leaf-buds or in modifying the habit of the plant.

There are more branches in the top of any plant than can persist; therefore there is struggle for existence. Those which have the advantage of position persist. Nature prunes. Dying and dead branches in any neglected tree-top are illustrations of this fact. Whenever the struggle for existence is greatly lessened, the remaining branches receive a greater proportion of the plant's energy, and they therefore make stronger growth, yield better produce, or are more productive in flowers and fruit. Pruning is essentially a thinning process.

There exist the widest variations of opinion as to the merits of pruning, particularly as it applies to fruit-trees. Some persons oppose any pruning whatever. Undoubtedly a certain type of novice places too high estimate on pruning, as if it were the one essential operation; others carry the practice to needless extremes; but the reasons for pruning lie in the nature of the plant, and the useful results are attested by long experience. It is one of the cardinal practices in the growing of many kinds of plants, along with tilling,

fertilizing, combating pests and diseases; and it is not to be considered as a thing apart or as a remedy or corrective for all deficiencies.

In itself pruning is not a devitalizing process; it is devitalizing only when it is carried to excess or when the wounds do not heal and disease sets in. It is rather an invigorating process, since it allows more nourishment to be distributed to the remaining parts of the plant. The notion that pruning is devitalizing arises from false analogy with animals, which suffer shock or injury when parts are removed. The fact that pruning is not a devitalizing process is proved by every tree. The tree is a record of successive prunings. Note the number of branches on the seedling tree in the nursery-row or in the forest, and then consider that all these branches, with the exception of the leader itself, will probably perish in



3198. More limbs have perished than have survived.—Nature's pruning.

the course of time. The forest tree develops a bole and the side limbs are pruned away by natural causes. (Fig. 3198.)

Knots are records of this natural pruning. In the greater number of cases the limbs die and are removed when still very young, and they leave small record in the grain of the wood; but all visible knots are histories of the removal of large branches. As a rule, it is only when the knots become knot-holes that injury results. A knot-hole means decay, and this decay may extend into the heart of the tree, finally causing it to become hollow. A discolored or decayed heart is an indication of disease. The disease originates on the outside of the plant; it is the result of inoculation. This inoculation takes place through some bruised or broken part; it is usually an infection of filamentous fungi. These fungi gain a foothold in the dead and dying cells of the wound, and as they grow they are able to destroy the living cells. The larger the wound, the greater is the liability to infection. It is very important, therefore, in the pruning of trees, that the wounds shall be as small as possible and shall heal quickly. This means that the best pruning is that which is practised annually, so that the branches to be removed do not attain to large size. This annual pruning is also most desirable for other reasons, as will be seen.

Pruning when transplanting.

Woody plants should always be pruned when they are transplanted. This is because the roots are pruned in the very process of removal, and the tops should be reduced in proportion. For some time after the plant is transplanted, it has very little vital connection with the soil, and if all the top is allowed to remain there is much evaporation from it and a dissipation of the energies. How much of the top shall be removed depends on how much of the roots was removed in digging, on climate, and also on personal desires of the operator. It is a general practice to cut back the top of a plant at least one-half on transplanting; in some cases still more of the top is removed. In broad-leaved evergreens, some of the leaves may be cut in two at transplanting, to reduce transpiration. (Fig. 3199, after Wester.)



3199. Pruning or cutting back of orange at time of transplanting.

Quite another question is the particular form in which the top shall be left. Some growers prefer to remove all side branches, if it is a fruit-tree, and leave a straight whip. (Fig. 3200.) They are then free to start the new branches where they like. This is allowable with very young trees, and it is much employed with peach trees, inasmuch as these trees are planted when the top is only of one season's growth. (Fig. 2792, page 2496.) If trees are two or three years old and well branched, as is the case with apples and pears, most persons prefer to leave three or four of the main branches to form the starting point of the future top. (Fig. 3201.) These branches may be headed back half or more of their length. Some years ago a method of very severe pruning came into notice under the name of the Stringfellow or stub-root system, taking its name from the late H. M. Stringfellow, of Texas (page 1598, Vol. III), who wrote much concerning it. The fullest presentation of Stringfellow's ideas will be found in his book, "The New Horticulture." It advises that practically all the roots be cut away and that the top be shortened to a straight stick 1 or 2 feet long, without side branches. It is the supposition that when trees are reduced to their lowest terms in this way, the new root-branches that arise will take a more natural form and the tree will assume more of the root character of a seedling. This method of transplanting has not gained acceptance.

In most cases, it will be better, particularly in trees that are three years or more old, to prune them only moderately, shortening them in all around, allowing a part of the original root-system and a part of the top to remain.

Whatever the way of pruning at transplanting, good live buds should be left on the tree; the practice of pruning two-year-old wood to a whip is therefore to be discouraged, for only dormant buds (if any) then remain on it.

Pruning fruit-trees.

Fruit-trees are pruned for the purpose of enabling them to produce a superior quality of fruit. In America, they usually are not pruned primarily to make them assume any definite or preconceived shape. It is best, as a rule, to allow each variety of tree to take its own natural or normal form, pruning it only sufficiently, so far as shape is concerned, to remove any unusual or unsymmetrical growths.

1. The fundamental conception in the pruning of fruit-trees is to reduce the struggle for existence, so that the remaining parts may yield larger and finer products.

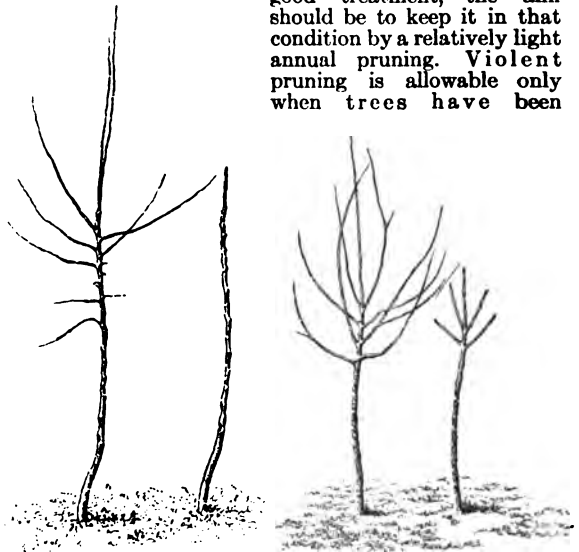
2. The result of pruning fruit-trees should be to keep the tree in bearing condition, not to force it into such condition. If the tree has received proper care from the time it is planted, it should come into bearing when it reaches the age of natural fruitfulness. Pruning aids to keep the tree in proper bearing condition. When trees have been much neglected, pruning may be the means of reinvigorating them and setting them into a thrifty condition. In such cases it is one of the means of renovating the tree, as are tilling, fertilizing, and spraying.

3. Heavy pruning of the top in any year tends to produce very vigorous growth on remaining parts. This is because the same amount of root energy is concentrated into a smaller extent of top, thereby causing a heavier growth. This is particularly true if the pruning is performed when the plant is dormant.

4. Heavy pruning of the root tends to lessen the production of wood, because the same amount of top receives a less supply of soil-water.

5. Trees that grow much to wood are likely to be relatively unproductive. It is an old maxim that checking growth induces fruitfulness, so long as the plant remains healthy. This, of course, does not mean that trees of decreased vigor are more fruitful, nor that the maintenance of full growth from the first is to be avoided. Orchards that are kept in a vigorous thrifty condition are most productive, other things being equal; but when very thrifty trees do not bear, the checking of the growth may induce the desired results. If the tree is thrown into redundant growth every two or three years by very heavy pruning, it tends to continue to produce shoots at the expense of fruit. When a tree is to be brought into bearing condition by general

good treatment, the aim should be to keep it in that condition by a relatively light annual pruning. Violent pruning is allowable only when trees have been



3200. Pruning peach tree at time of transplanting.

3201. Pruning of a young tree on transplanting.

neglected and it is necessary to bring them back into bearing condition by renewal or to re-shape them.

6. The operator should know where the fruit-buds are borne before undertaking the pruning of any fruit-tree; otherwise he may destroy too many of them. If he knows the position of the fruit-buds, he may prune

in such way as to thin the fruit even without the removal of much wood, and thereby to reduce the struggle for existence to a minimum. Every species of tree has its own method of fruit-bearing. The pear bears its fruit largely on old spurs. The peach bears mostly on the long wood of the last season's growth, particularly when trees are young. If one is to thin the fruit of the pear by pruning, therefore, it is necessary to remove part of the spurs. In the peach it is necessary to cut out or to cut back a part of the previous year's growth. Each species of plant is a law unto itself in these regards.

7. Heading-in under certain conditions (which the operator must judge by observation) tends to promote fruitfulness. If the heading-in is very severe it may amount to a heavy pruning, and in that case it may

3202. Young apple tree, the marks showing which limbs may be removed to advantage.

set the plant into shoot-bearing rather than into fruit-bearing. It is not to be supposed that heading-in is necessarily to be advised in order to make trees bear. They may bear just as well if they are never headed-in, provided they are otherwise well pruned and well cared for. Whether one shall head-in the fruit-trees or not, is in part a personal question. If the trees are growing too rapidly, it is well to head them back. This may be necessary when trees are growing on very fertile soil in order to keep them within bounds; but the heading-in under these conditions may not conduce to greater fruitfulness. When trees are planted too close together, it may also be necessary in order to prevent the plantation from becoming too thick. Some growers like a low-headed and rounded top; this is a question of personal preference and of the general management of the plantation. If the orchardist desires such form, it is necessary to head-in the tree. It should be remembered that the more a tree is headed-in the thicker it tends to become in the crown and the more inside pruning is necessary. Whenever there is danger of fruit-rot, as in plums and early peaches, it is a question whether the thick form of top is the most advisable.

8. Pinching-in the annual growths in early summer tends to augment the development of fruit-buds, although these buds may not be

developed the very year in which the pinching-in is performed. This is a special practice, however, which can be employed only on small areas and with particular trees. It is essentially a garden practice and not an orchard practice. In the orchard, one must depend for fruitfulness on the general good care of the plantation, and in this care pruning is one of the essential factors.

9. Pruning fruit-trees usually resolves itself into a thorough and systematic thinning out of the weak, imperfect and interfering branches. Thereby, the energy of the plant is saved and is deflected to those parts that are capable of bearing a useful product. The sun and air are admitted. The tree becomes manageable for spraying and for picking. All the fruits have an opportunity to develop. How much or how little to thin, is a special question. In humid climates, much thinning may be necessary. In dry hot climates, as on the Plains, but little thinning is allowable, else the branches may sunscald. Figs. 3202 and 3203 illustrate two pruning ideals.

10. Scraping the rough bark from old trunks may be a desirable practice, since it destroys the breeding places of insects and fungi. Trees that have been continuously thrifty, however—that have received uniformly good tillage, fertilizing, pruning, spraying—rarely need to be scraped, as the bark remains relatively smooth and firm. Only the loose outer bark should be removed. On ornamental trees, the bark is a part of the characteristic beauty, and it should not be scraped. Although not a pruning question, this is closely associated with pruning practices.

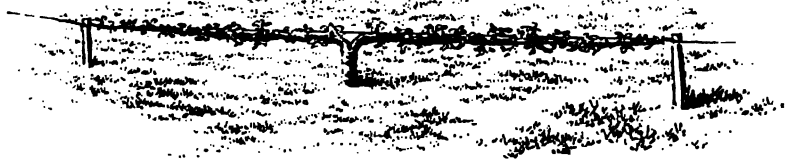
Pruning ornamental plants.

Ornamental trees and shrubs are pruned for three purposes: (1) to enable them to produce greater quantity of bloom; (2) to make them take some desired form; (3) to remove unusual or injured growths.

The pruning of woody plants for the production of flowers is controlled largely by the flower-bearing habit of the plant. Most early-blooming plants develop their flower-buds the year before. Heavy pruning, therefore, particularly heading-in, when the plants are dormant, cuts off the flower-buds and the amount of bloom is lessened. If these plants are pruned just after the flowers are passed in spring, the best results will be secured, since the new growths will then develop flower-buds for the year following. Among spring-flowering

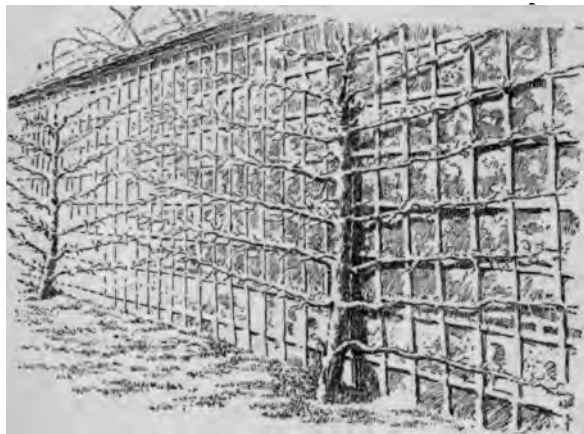


3203. A New York cherry-grower's ideal of a Montmorency cherry tree. Perhaps the large branch on the front side should have been removed when the tree was young.



3204. Cordon training. An apple tree (grafted on dwarf stock) trained in two branches on a horizontal wire running only 2 feet above the ground. Each year the growths are cut back to spurs.

shrubs that may be pruned after flowering (while in leaf), are deutzias, diervillas or weigelas, forsythias, lilacs, flowering almond, wistaria, exochorda, and many spireas and viburnums. It may be advisable, however, to prune such plants in winter for the purpose of thinning them, thereby allowing the flower-buds that



3205. Pear trees trained on a wall. When once the wall is covered, the tree is never allowed to increase in surface area. It is cut back to spurs each year, much as grape-vines may be treated.

remain to produce larger bloom. In most ornamental plants, however, it is the number of flowers rather than the size of each which is desired.

Plants that bloom late in the season, as hydrangeas and most species of clematis, make their flower-buds on shoots which arise that very season. With such plants, it is well to prune rather heavily while they are dormant in order to cause them to throw up a profusion of strong shoots in the spring. These shoots will bear that summer. Among the summer-flowering shrubs that may best be pruned when dormant, are hydrangeas, althea or hibiscus, ligustrums, trumpet creeper, ceanothus, potentillas, vitex, symphoricarpos, and many kinds of clematis, lonicera, jasminum, and some spireas.

Pruning to make the plant assume some definite form is essentially a method of shearing or heading-in. If it is desired to have a very regular and definite shape, it is well to shear the plant at least two or three times a year in order to keep down the exuberant growths. It is a common practice to shear the plants only in the winter, but if this shearing is somewhat violent, as is usually the case, the plant throws up numerous strong shoots very early in spring and it remains shapeless during a large part of the growing season. Except in very special cases and for formal landscape work, it is much better to let shrubs and trees assume their natural and characteristic forms; these forms, in fact, constitute the beauty of the species.

Training.

There is relatively little careful training of plants in North America, largely because of the expense of the skilled labor necessary to perform it. Land is also relatively cheap, and room can be given for the natural development of most plants. In many parts of the Old World, fruit-plants must be grown in very small areas, and it may be necessary to train them on walls, sides of buildings, or on trellises of various kinds. Trained fruit-trees may generally be referred to one of three categories: the wall tree, which is trained against a continuous surface; the espalier, which is trained on a trellis, the branches starting at nearly right angles from a central shaft; the cordon, or training to a single or double strand near the ground. Properly, an espalier

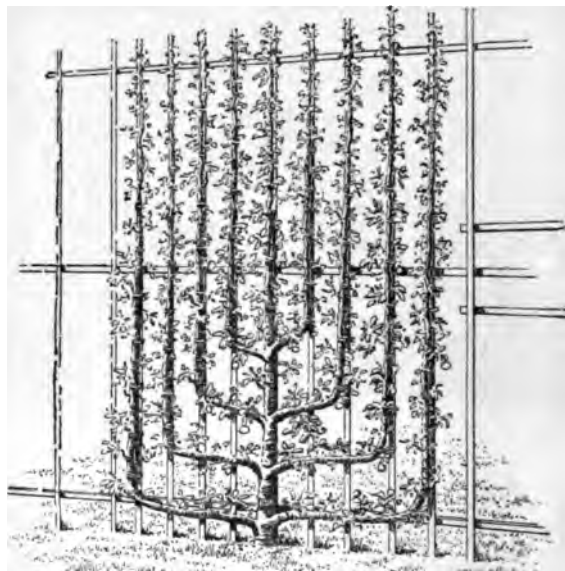
is a trellis (page 1146), but the word is commonly used for the plant that is trained on the trellis. There are many variations in the methods of training and pruning in each of these three classes, and the methods are such as can scarcely be well elucidated in writing. The Old-World literature is replete with instructions. In recent American literature, the fullest account is to be found in "The Pruning-Manual." In order that trees may be well trained on walls, espaliers, and cordons, it is necessary that the training be begun in the nursery. The Old-World nurseries grow plants that are trained for various uses, but the American nurseries do not. If, therefore, the American is to train trees in any of these formal shapes, he should secure specimens that are not more than one year from the bud or graft, and begin the training himself. The illustrations (Figs. 3204-3206) suggest some of the special methods of training fruit-trees. On such trees, if skilfully trained and carried out in patient detail, the best excellence in individual fruits may be attained.

Pruning after frost-injury.

When woody plants have been much injured by freezing, it is the best practice to remove all dead parts as soon as the line of demarcation is evident.

The kind of corrective pruning to be employed when trees have been much shattered by winter cold is a subject that needs further investigation. It is not a single or a simple problem, as much depends on the previous state of the trees and on other conditions. Speaking of peach trees, Chandler writes (Research Bulletin No. 8, Missouri Experiment Station): "Pruning the trees severely following a winter when the wood has been killed, although apparently in the best condition of maturity, seems to reduce the amount of killing. However, such pruning following winters when the wood has been killed on account of its not having reached the proper condition of maturity in the fall, generally due to the presence of wet weather following a drought the season before, is liable to result in greater loss than if no pruning were done."

On the proper practice to pursue in the case of frozen citrus trees, T. F. Hunt issued the following advice



3206. Apple tree trained on an espalier.

to California growers following the freeze of January, 1913: "Relative to badly injured trees, it appears best not to prune until the new growth has started. It is best to delay the pruning until a distinct line of demarcation develops between the injured and uninjured wood. At the Citrus Experiment Station last year five-year-old lemon trees were frosted. Good results were obtained by waiting until the new growth had reached from 4 to 5 inches in length; in that instance about six weeks were required. Allowing the injured limbs to remain not only makes it possible to determine how much it is best to prune, but the limbs and leaves afford shade to the bark of the tree, which is accustomed to protection.



3207. A proper cut.—The healing tissue arises from the side of the wound, not from the hard wood.

It may be desirable, in some instances, to spray the trunks and limbs of large and severely pruned trees with whitewash in order to reflect the sun's rays. Wrapping the trunks of young trees with loose sun protectors would seem extremely desirable.

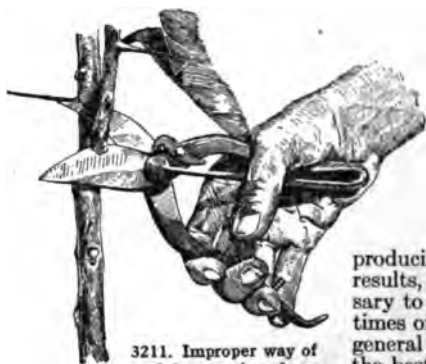
"It seems reasonably certain that no injury to the tree can result from any of the materials passing from the frozen oranges into the tree. An examination of those oranges which have been too badly frozen to be fit for shipment shows that most of them only partially have been killed; consequently, they are presumably respiring carbon dioxide. This loss of energy would be saved if the oranges were removed from the tree. There is no experimental evidence, however, to show whether this loss is sufficient to warrant the cost of early removal by hand."

When to prune.

It will be gleaned from the above discussion that the time of pruning depends on many circumstances, and chiefly on the result which it is desired to reach. So far as the healing of the wound is concerned, it is

perhaps best to prune when the vegetative activities begin in spring so that the wound is quickly covered or "healed." For the purpose of checking growth and

producing other definite results, it may be necessary to prune at other times of the year. As a general rule, however, the best time to prune



3211. Improper way of applying pruning-shears.

is in late autumn to early spring, when labor can be had and before the rush of spring work comes on. In practice, it resolves itself largely into a question of the convenience of the operator.

The wound.

The wound made by severing a branch heals by means of a callus which forms from the growing tissue between the bark and wood. (Fig. 3207.) This tissue rolls over the wound, finally joining in the center and completely covering the old wood. The old wood itself takes no part in the healing process; in fact, it dies. When the healing is complete, the old wood is merely covered and preserved from external injury and infection, much as fruit in a jar is preserved by being protected with a tight cover. There is no dressing that will hasten the healing process except as it keeps the wood from decay. In other words, the whole object of dressing a wound is to protect it. The dressing hinders bacteria and fungi from securing a foothold and thereby prevents the rot. Wounds that are exposed for some years nearly always become unsound at the center because of the intrusion of these organisms, and even if the wounds should subsequently heal over, the infection may still extend down the heart of the tree and finally cause its death. The best covering for a wound

is one that protects it best from weather, microbes, and fungi and which persists the longest. Ordinarily, good white lead paint, applied heavily and renewed occasionally, is a good pro-



3209. The stub is longer than necessary, although the fault is not a serious one. It will heal well if the old wood is kept healthy.

tection for fruit trees. Grafting-wax may afford a fair protection, if it is applied warm and thin so that it soaks into the tissue. If it is merely spread over the surface, it soon blisters and becomes loose and affords relatively little protection. For shade and forest trees, which are treated by "tree surgeons," special dressings and disinfectants are employed.

The rapidity with which wounds heal depends very largely on their position on the tree and the way in which they are made. Wounds along the main branches, which are the leading avenues for distribution of food, heal more speedily than those on the weaker side branches. If the wound is close to the branch it may be expected to heal better. (Figs. 3208, 3209.) If a stub is left several inches long (Fig. 3210), it seldom heals until it rots back to the main branch or trunk; and by that time the decayed part may have extended deep into the tissue of the tree. It is a common notion that a limb should be cut at right angles to the direction of the limb itself and beyond the bulge at its base. It is a better plan, however, to make the wound parallel to the direction of the branch or trunk that remains, and closer to it. This wound may have a somewhat larger superficial area, but it is much nearer the source of the healing food-supply.



3210. Common fault in pruning. This wound cannot heal until the stub rots away, and by that time the tree may be irreparably diseased.

Tools.

A good large-bladed large-handled sharp knife, a narrow and pointed rather fine-toothed saw, and a pair of shears are the essential pruning tools. Many forms of these three primary implements are on the market.



3212.
A good
ladder for
pruning or
picking.

In tools that require such incessant use, when the work is in progress, and that meet such resisting obstacles, only the best makes and materials should be secured. The operator must learn by practice how to use them, for even in such simple implements as these there is a right way and a wrong way. Fig. 3211 (from Wester), for example, shows an improper way of using shears, cutting at such a long acute angle rather than crosswise or merely oblique as to render the work difficult, leave a long sharp stub, and injure the shears. A good ladder is also necessary for large trees. When the top or head of the tree is low enough, the pointed ladder shown in Fig. 3212 (from Wester, a bamboo ladder used in the Philippines) is one of the best types; it is easily inserted among the branches and it may be rested securely in a crotch. Many other pruning implements are useful for special work, and suggestions of these will be found in various bulletins and in the catalogues of dealers. See also the discussion in Vol. IV, page 1950.

L. H. B.

PRUNUS (ancient Latin name of plum). *Rosaceæ*. THE STONE-FRUIITS, as PLUM, CHERRY, PEACH, NECTARINE, APRICOT, ALMOND. Pink-flowered and white-flowered shrubs and trees of wide distribution, grown for fruit, and also for ornamental foliage and flowers.

All woody plants: lvs. alternate, simple, usually serrate and more or less gland-bearing: fls. mostly in spring, sometimes preceding the leaves, either solitary or in clusters, perfect, the pistil single (more than 1 in abnormal forms) in a cupule or cup (usually designated the calyx-tube), the stamens numerous and perigynous, the petals and calyx-lobes 5: fr. a drupe, usually 1-seeded by the abortion of one of the 2 ovules. (Fig. 3213.)—The species are probably 175, mostly in the North Temperate zone, although a number of species are native in the Andean parts of S. Amer.

The genus as here outlined includes several well-marked groups, some of which are regarded as distinct genera by many authors. In their extreme or typical forms, these subgenera are very distinct, but the group as a whole is well defined and nothing is contributed to clear definition by raising the groups into generic rank, and it is an advantage for easy reference to have all forms treated in one place rather than to scatter them under several different names. A marked group is *Padus*, with flowers in true racemes; and its ally, *Laurocerasus*, is also fairly well distinguished.

Horticulturally, *Prunus* is one of the most interesting of all genera. It includes important orchard fruits,—peaches, plums, cherries, apricots, and almonds. It is also prolific of ornamental subjects, as double-flowered, variegated-leaved, colored-leaved and weeping forms. Most of the cultivated species are hardy in the latitude of Philadelphia and many are hardy in Ontario. All are of easy culture. Nearly all the species are spring-flowering. Only *P. Cerasus* var. *semperflorens*, amongst the commoner kinds, blooms as late as midsummer. They are very useful for spring gardens, therefore, where they make great display, but their short season of bloom and the very ordinary foliage of most of them have limited the planting of the ornamental kinds. All members of the genus are easily grown.

Some of the ornamental species are not grown on their own roots, but are worked on stocks that can be

grown easily and cheaply and of which seeds can be secured in abundance. The commonest stocks for the ornamental kinds are the plum (*P. domestica*), peach, and sweet cherry. On the plum are grown the dwarf almonds and the double-flowering and fancy-foliage plums. The Myrobalan plum (*P. cerasifera*) is sometimes used for the same purpose. Peach stocks may be used for the same species, as a rule; and they are also employed, particularly in the South, for many fruit-bearing plums. The sweet cherry (*P. avium*) is a good stock for the various kinds of double-flowered, weeping and fancy-leaved cherries. It is an important point in the growing of these grafted prunuses to remove all sprouts from the stock as soon as they appear. This is particularly true of the dwarf almonds, since the stocks are usually stronger-growing species and tend to sucker from the root.

In North America there has been a remarkable contemporaneous evolution of fruit-bearing plums from the native species. Several hundred orchard varieties have been described, and the trees are grown commercially over a wide range of country in the South, in the Mississippi Valley and on the Plains,—in regions in which the common *Prunus domestica* does not thrive. An interesting group of pubescent-fruited species of the Southwest may have horticultural importance in future. (See S. C. Mason, Journ. Agric. Research, 1913.)

In Europe and Eurasia, the fruit-bearing cherries and plums had their original development, chiefly from the three species-groups, *P. Cerasus*, *P. avium*, and *P. domestica*. Ornamental forms are incidental or secondary. In North America, the horticultural development has been chiefly in edible forms of plums. In the Orient—farther Asia and the Chino-Japanese region—the peach and apricot groups probably had their origin, as well also as the fruit known to us as the Japanese plum; but Japan is noted for its cherries cultivated for bloom rather than for fruits. Only the indifferent *P. Pseudo-Cerasus*, among the cherries, is natively grown for fruit in China and Japan.

The Japanese flowering cherries are singularly beautiful and attractive. They should be better known in this country. A number of forms have been long introduced and a few of them are advertised, but apparently they have not been carefully chosen as to hardiness and adaptability. David Fairchild reports that the trunks of the less vigorous forms of his ten-year-old collection in Maryland are sometimes winter-killed, especially on the southwest side, but there are many which, at least in Maryland, are hardy and form good-sized trees. The



3213. Flowers of plum. The ovary, or young plum, with the ovule inside, is at o. (Natural size.)

drooping single forms (*P. subhirtella* var. *pendula*) are among the hardiest and most showy from a distance, but are surpassed by the wonderful double forms (*P. serrulata*) which produce great masses of flowers as beautiful and quite as large as many semi-double roses. The question of stock is important. In Europe, nurserymen have generally grafted the Japanese cherry on *P. Cerasus* and *P. avium*, as well as on the Mahaleb. Most of the specimens of the pendula varieties commonly seen are grafted high on one of these stocks, but the effect in old specimens is grotesque and the trees are short-lived. The Japanese grafted trees sent to this country

are on a wild stock called the Mazakura (*P. Lannesiana*) which grows easily from cuttings and according to experiments made by the Department of Agriculture is almost immune to the cherry leaf-spot. As the grafting is at the surface of the ground, and as the trunks of the trees are the parts winter-killed, it is yet an open question as to whether the substitution of a longer-lived hardier stock would produce hardier longer-lived trees. E. H. Wilson, of the Arnold Arboretum, who has made a critical study of the Japanese cherries both in the Orient and at the Arboretum, thinks it will, and has suggested the trial for this purpose of *P. serrulata* var. *sachalinensis*. The Mazakura grows readily from cuttings, but *P. serrulata* var. *sachalinensis* does not. Buds have been successfully placed on the latter, and we shall be able to determine whether the stock transmits a greater longevity to them. With the tests being made by the Arnold Arboretum, the Department of Agriculture and in New York city, and the botanical studies of Wilson and Miyoshi, we should soon have a reliable planting of these very desirable oriental cherries. In anticipation of this, the names of many of the Japanese forms have been inserted in the following systematic account, although one may expect variations in the rendering of them into English.

In very recent years, the knowledge of the genus has been greatly extended by explorations in China, whence many new species (particularly in the subgenera *Cerasus* and *Padus*) have been derived that will probably find their way into cultivation. The taxonomy of the American native plums has also received much recent attention. Aside from the older writings of Bailey and Waugh on the native edible plums and cherries, see Hedrick, "The Plums of New York," 1911, and "The Cherries of New York," 1915 (also with similar accounts of all other pomological species), and Wight, "Varieties of Plums Derived from Native American Species," Bulletin No. 172, Bureau of Plant Industry, United States Department of Agriculture, 1915, and "Native American Species of *Prunus*," Bulletin No. 179 (1915). For the oriental *Prunus*, particularly those native in China, see the work by Koehne and others in "Plantæ Wilsonianæ," vol. 1, 1911-1913, and Wilson's "Cherries of Japan" (1916), published by the Arnold Arboretum, Boston. As this writing is being closed in the printery, a paper on the Japanese cherries appears in Japan: Miyoshi, "Japanische Bergkirschen," in Journ. Coll. Sci. Tokyo, vol. 34, art. 1 (1916) with eighty-nine colored figures.

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KEY TO THE GROUPS.

- A. *Les. convolute in the bud* (i. e., rolled up, showing well as the lvs. begin to emerge from the bud): *ovary usually furrowed lengthwise*. There are exceptions in some of the American native plums (Nos. 14, 15, 19 and others) in which the lvs. are conduplicate in vernation; also No. 10: these species and their allies are intermediate between the true plums and the cherries.
- I. PRUNOPHORA, PLUMS, PRUNES, AND APRICOTS, Nos. 1-26.
- AA. *Les. folded or conduplicate* (trough-shaped, folded lengthwise along the midrib) in the bud.
- B. *Fr. normally soft-hairy* (except in 33 var.); *stone or pit often furrowed and pitted: fl.-cup short and wide-spreading*.
- II. AMYGDALUS, ALMONDS, AND PEACHES, Nos. 27-34.
- BB. *Fr. very juicy, glabrous or only very slightly hairy; stone smooth or roughish*.
- C. *Fls. in fascicles or cymes*.
- III. CERASUS, COMMON OR FASCICLED CHERRIES, Nos. 35-69.
- CC. *Fls. in racemes*.
- IV. PADUS, RACEMOSE CHERRIES, Nos. 70-82.

Subgenus I. PRUNOPHORA. Apricots and Plums.

Fr. sulcate, glabrous and usually glaucous (except in the apricots), the stone compressed and usually longer than broad and smooth or nearly so: *fls. solitary or in umbel-like cymes, mostly appearing before the lvs. or with them: lvs. mostly convolute* (but often conduplicate) in vernation, generally ovate or lance-ovate.

A. *Apricots—the fls. solitary or in 2's, before the lvs. and the fr. velvety* (at least until ripe): *stone usually sulcate on the margin: peduncle separating from the mature fr.* See Apricot.

1. *Armeniaca*, Linn. (*Armeniaca vulgaris*, Lam.). COMMON APRICOT. Figs. 279-284, Vol. I. Small round-topped tree with reddish bark much like that of the peach tree: *lvs. ovate to round-ovate, sometimes slightly cordate at the base, abruptly short-pointed, glabrous* (at least above), closely serrate, the stalks



3214. *Prunus Mume* ($\times \frac{1}{2}$). No. 2.

stout and gland-bearing: *fls. pinkish, solitary and sessile or very nearly so, appearing from lateral buds of last year's growth* (sometimes on short year-old spurs) before the lvs.: *fr. variable, nearly smooth when ripe, short-stalked like a peach, usually somewhat flattened, mostly yellow and overlaid more or less with red, the stone flat and smooth, ridged or sulcate on one edge*. Probably Siberia (Dahuria, Manchuria) to China as a native plant. It early reached Eu., where it was once supposed to be native of Armenia, whence the name *Armeniaca*. The Russian apricot is a hardy race of this species. Var. *péndula*, Dipp., has hanging or pendulous

twigs. Var. *variegata*, Hort., has white-variegated foliage.—*P. Armeniaca* is apparently widespread in farther Asia and it is variable. By some authors the main forms are separated as species but the differences appear to be too unimportant or inconstant for clear definition and they are here retained as varieties.

Var. *sibirica*, Koch (*P. sibirica*, Linn. *Armeniaca sibirica*, Pers.). SIBERIAN APRICOT. Bush or small tree, 10 or 12 ft. high: *lvs. small and glabrous, or sometimes sparingly bearded beneath, ovate to rounded, long-pointed, unequally crenate-serrate: fls. white or pink, appearing early in the season and usually in great profusion, subsessile, the calyx minutely puberulent: fr. globular, rarely more than $\frac{1}{2}$ in. diam., yellow with a reddish cheek, scarcely fleshy, practically inedible, finally splitting; stone smooth, very sharp-edged*. Mongolia, Dahuria. L.B.C. 17:1627.—Sometimes planted as an ornamental bush.

Var. *mandshurica*, Maxim. (*P. mandshurica*, Koehne). *Lvs. rounded, subcordate or cuneate at base, at apex long-cuspidate and acute, margin strongly double-toothed, the teeth sharp and twice longer than wide: peduncle long* (about $\frac{1}{4}$ in.): *fr. nearly globular, scarcely 1 in. long, yellow, red-spotted, succulent and sweet; stone small and smooth, the margin obtuse, the seed sweet*. Manchuria.—Distinguished by the narrow sharp teeth and double serration of the lvs.; kept as a distinct species by some authors.

Var. *Ansh*, Maxim. (*P. Ansh*, Komar.). *Lvs. broad-elliptic, at base short-cuneate, at apex acuminate, very glabrous, the margins crenate-serrate: peduncles hispid: fls. twin: fr. subglobose, deeply umbilicate or sulcate, red, tomentose, the flesh grayish brown and sweet and free from the minutely reticulated stone which has one very sharp edge*. Japan; cult.—Retained as a separate species by some, being marked by the cuneate base of the lf.

2. *Mume*, Sieb. & Zucc. (*Armeniaca Mume*, Sieb.). JAPANESE APRICOT. Fig. 3214; also Fig. 279, Vol. I. Tree of the dimensions of the common apricot, but the bark greenish or gray and the foliage duller in color: *branchlets green: lvs. relatively small, narrow-ovate to nearly round-ovate, long-pointed, finely and sharply serrate, more or less scabrous, lighter-colored beneath, the petioles mostly gland-bearing: fls. sessile or nearly so, fragrant: fr. mostly smaller than that of *P. Armeniaca*, yellow or greenish, the dry flesh adhering to the pitted stone*. Japan, where it is much grown for its fls. Gn. 50:164. R.H. 1885:564. G.C. III. 29:183.—Planted to some extent in the S., particularly in the form known as Bungo or Bongoume apricot or plum, but of minor value. When top-worked on plum, it withstands the winters of Cent. N. Y., but does not bear. The apricot cult. as Chinese or Shense is also of this species. There are many double-fl. forms in Japan, where it is much prized for decoration. Var. *Goethartiana*, Koehne. *Lvs. as in *P. Mume*, rather large: calyx-tube and lobes pubescent*. Japan. Var. *álbo-pléna*, Hort., fls. double, rose in bud then white. Gt. 52:1513b. Other Latin-named varieties are recorded, as forms *laciniata*, Maxim., var. *microcarpa*, var. *viridicalyx*, and var. *cryptopétala*, Makino.

3. *brigantiaca*, Vill. (*Armeniaca brigantiaca*, Pers. *P. Armeniaca* subsp. *brigantiaca*, Dipp.). ALPINE PLUM. Shrub or small thornless tree, with mostly smaller lvs. and smaller smooth subacid fr. the size of a small green-gage plum: *lvs. broad-oval or ovate, the blade 2-3 in. long, abruptly short-pointed, very sharp-serrate, above glabrous or essentially so, beneath lighter-colored and more or less hairy on rib and nerves, the petiole gland-bearing and usually less than 1 in. long: fls. white, about $\frac{1}{2}$ in. across*. French Alps.

4. *dasycarpa*, Ehrh. (*P. Armeniaca* var. *dasycarpa*, Koch). PURPLE OR BLACK APRICOT. Small tree, of

the stature of the common apricot: lvs. smaller and narrower, mostly elliptic-ovate, finely and closely serrate, thin, dull green, the stalks slender and nearly or quite glandless: fls. large and long-stalked, showy: fr. globular and plum-like on a distinct st., pubescent at maturity, dark purple, the flesh soft and sourish; stone fuzzy. Probably native to Manchuria. B.R. 1243. L.B.C. 13:1250.—Sometimes planted, mostly as an ornamental tree, for the fr. has little value compared to that of the common apricot. Hardy in the N.

AA. *Plums*,—the fls. mostly in cymes, in most species appearing with the lvs. in the N. (before the lvs. in the S.), and the fr. smooth and glaucous: stone not prominently sulcate: peduncle slender, usually remaining with the fr. (exception in No. 12). See *Plum*, *Prune*.

B. Group of *Eurasian plums*: lvs. relatively broad, usually prominently reticulated and more or less pubescent (at least beneath), the young twigs mostly pubescent: fl.-clusters with mostly 1 or 2 fls. from each bud.

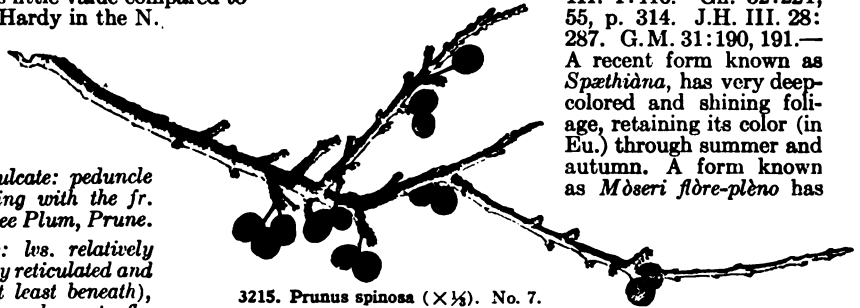
c. Fl.-stls. glabrous.

5. *cerasifera*, Ehrh. (*P. domestica* var. *Myrobalan*, Linn. *P. Myrobalana*, Loisel.). CHERRY PLUM. Slender twiggy grower, often thorny, the tree small or sometimes shrub-like; twigs usually soon becoming glabrous: lvs. rather small and thin, also lightish green, becoming nearly or quite glabrous, short-ovate and short-pointed, finely serrate: fls. rather small as compared with most forms of *P. domestica*, white or blush, slender-stalked: fr. small (usually 1 in. or less diam.), globular and cherry-like, depressed about the st., yellow or red, the flesh soft, juicy, and sweet-flavored. Probably native to the Caucasus and S. W. Asia, although early attributed to N. Amer. B.M. 5934. Gn. 33, p. 252. J.H. III. 28:267.—The *Myrobalan* plum is a culture-form of this species, with rather large and good fr., by some regarded as a subspecies or variety *Myrobalana*. It is extensively used in this country as a stock on which to bud the domestica plums, the seedlings being imported in great quantities from Eu. It is a smaller tree than *P. domestica*, with much more slender growth, smoother twigs and lvs., smaller and mostly earlier fls., and also smaller softer fr. with a depression about the st. It tends to dwarf the domestica plums, but its influence in this direction is not sufficient to discourage its use as a stock. Its advantages as a stock are its cheapness, the ease with which all domestica varieties "take" on it, and the readiness with which it can be grown in the nursery row. It is not used to any extent as stocks for other plums than the domesticas. Spontaneous trees are sometimes found about old nursery grounds, and it occasionally appears in orchards when the top of a plum tree dies and sprouts arise from the root. There are also a few varieties prop. for the early juicy frs., but they are little known. It makes a good ornamental tree. The *Marianna*, much used for stocks of many kinds of plums in the S. (and growing from cuttings), is probably a hybrid of this species with *P. hortulana* or *P. angustifolia*. There are several cult. forms of *P. cerasifera*, one of the best being the plant known as *P. planeriensis*, Hort., with full double white and red fls. There are also forms with yellow- and white-variegated lvs., and a weeping form (var. *pendula*, Hort.). A form with narrow willow-like lvs. (var. *acutifolia* or *angustifolia*, Hort.) is also advertised. A form with twisted or contorted foliage is shown in R.H. 1895, p. 201.

Var. *Pissardii*, Koehne (*P. Pissardii*, Carr. *P. cerasifera* var. *atropurpurea*, Dipp.). A handsome form with purple lvs. and dark wine-red fr.—Intro. into

France by Pissard, gardener to the Shah of Persia, and first fully described in *Revue Horticole* in 1881. It is a cultural form of *P. cerasifera*. It is one of the best of all small purple-lvd. trees, holding much of its color in the American summers. It seems to be hardy wherever the common plum will stand. The best color is secured on the strong growths; therefore it is well to head back the tree frequently. R.H. 1881:190; 1884:396. G.C.

III. 1:416. Gn. 32:224; 55, p. 314. J.H. III. 28:287. G.M. 31:190, 191.—A recent form known as *Spæthiana*, has very deep-colored and shining foliage, retaining its color (in Eu.) through summer and autumn. A form known as *Möseri flore-pleno* has



3215. *Prunus spinosa* (× 1/4). No. 7.

double pink fls. G.M. 55:819. The form called *Hessei* (*P. Pissardii* var. *Hessei*, Purp.) has narrow irregularly cut and toothed usually long-acuminate lvs., red with a broad greenish yellow or crimson-red border. *Purpurea* (*P. Pissardii* var. *Purpurea*, Hesse) has lvs. similar in shape to those of usual var. *Pissardii*, dark red and variegated with yellow and bright rose. The form *nigra* has very dark purple lvs. *Blirieana* (*P. Blirieana flore-pleno*, Carr.) is a very handsome form with long slender branches bearing purple-tinted foliage and semi-double apple-blossom-pink fls. R.H. 1905:392. Gn. 78, p. 203. G.M. 57:334.

Var. *divaricata*, Bailey (*P. divaricata*, Ledeb. *P. cerasifera* subsp. *divaricata*, Schneid.). Branching from the base, the branches wide-spreading and some of them nearly or quite prostrate: lvs. broader toward the base: fr. not depressed about the st., yellow. Macedonia to N. Persia. B.M. 6519.

6. *Coccomlia*, Ten. ITALIAN PLUM. Allied to *P. cerasifera*. Bush or small tree, with thorny branches and young growth glabrous: lvs. oval or broadly ovate to roundish obovate, sharp-serrate, glabrous above, more or less pubescent on nerves beneath or glabrous, tapering below, somewhat pointed: fls. usually in pairs, appearing with the lvs. or just preceding them, white or greenish white, the calyx-tube about the length of the pedicels: fr. small and yellow, globular or oblong-ovoid, rather good for eating. Italy.

7. *spinosa*, Linn. BLACKTHORN. Fig. 3215. Low and spreading, making a very thick thorny top, the young growths distinctly pubescent: lvs. small, oblong-obovate or elliptic-ovate, very numerous on the branches, nearly or quite obtuse, very finely and closely serrate: fls. white, small, borne singly or in pairs (or sometimes in 3's) and often on the thorns: fr. little larger than a very large pea, very deep glaucous-blue, usually persisting until winter, scarcely edible. Cent. and S. Eu. and N. Afr. to N. Persia and Siberia. G.C. III. 42:308.—Sometimes planted in this country, chiefly in the double-fl'd. form, var. *plena*, Hort. (Gn. 59, p. 76; 61, p. 363. G.M. 44:165). It is an excellent bush or small tree for protecting the borders and corners of drives and walks. The short stiff thorny branches make a good barrier. The tree is perfectly hardy where the plum can be grown. The little frs. are usually astringent, but there is a sweet-fruited form. It has been supposed by some that the domestica plums may have come from this species, but this is very doubtful, at least within the period of human experience with them. Var. *purpurea*, Hort., has purple foliage; fls. small and very numerous, pink: tree less spiny than the type.

cc. *Fl.-sts. usually more or less hairy.*

8. *domestica*, Linn. (*P. communis*, Huds.). COMMON GARDEN PLUM. Figs. 3068 to 3072. Strong-growing small tree with pubescent twigs: lvs. large and thick, dull green, much reticulated, pubescent beneath, ovate or obovate, coarsely and irregularly serrate: fls. white, large, usually in clusters: fr. various, but firm in texture and usually not depressed about the st.; stone large, slightly rough or pitted.—Native country unknown, but of Eu. or the Eurasian region. If it exists in a truly wild state, it is to be sought in the Caucasus and trans-Caucasus regions. It is run wild in many parts of the world. Focke says that *P. domestica* is unknown in an originally wild state, and that the typical form of the species is the prune (*Zwetsche*), *P. aconomatica*, Borkh. There are various forms of *P. domestica* grown for ornament, as double-fl., yellow-lvd., and variegated-lvd. As a fr.-plant it is widely variable. It is the parent species of the old-time or common plums, as distinguished from the Japanese and American plums. The synonymy of the main varietal groups is shown by Waugh, Bot. Gaz. 26, pp. 417-27 (Dec., 1898), and 27, pp. 478-81.

Var. *insittia*, Bailey (*P. insittia*, Linn. *P. domestica* subsp. *insittia*, Schneid. *P. idlica*, Borkh.). DAMSON, BULLACE, and probably also ST. JULIEN, and other kinds of plums. A form with small foliage and small firm oval or ovoid frs. borne mostly in clusters: tree small and compact.—Damson is a general name for small-fruited and small-lvd. forms of the plum. When the plum runs wild, it usually reverts to this form. Some of the Damsons (as the French, Shropshire, Farleigh) are commercial orchard varieties, being used for culinary purposes. The Mirabelle plum is *P. insittia* var. *syriaca*, Koehne. There is much difference of opinion as to the systematic position of the plum designated by Linnæus as *P. insittia*, but in character it is somewhat intermediate between *P. domestica* and *P. spinosa*. It is probably one



3216. *Prunus salicina*.—Japanese plum.
From specimens in the herbarium at the Royal Gardens, Kew, as *P. triflora*, Roxbg. (No. 9.)

stage in the reversion of the plum toward wild or half-wild forms. The *P. domestica* var. *damascena*, Linn., is indefinite, and the name may well be dropped.

Other forms of *P. domestica* have received Latin class-names, as var. *maliformis*, Linn. (*P. syriaca*, Dipp.), including the Mirabelle (a small-lvd. form with small yellow fr., not unlike the Damsons) and others;



var. *Cerëola*, Linn., the green-gages or Reine Claudes; var. *galatensis*, Auth., the prunes. Var. *élegans*, Hort., a recent form, has narrow white-margined lvs.

BB. Group of oriental plums: lvs. relatively longer (mostly oblong-obovate), not roughened or pubescent, often shining, the young twigs glabrous or nearly so: fls. mostly 3's from each bud in the cluster.

9. *salicina*, Lindl. (*P. triflora*, Roxbg., nomen nudum. *P. japonica*, Hort., not Thunb. *P. Hulan*, Tamari. *P. ichangana*, Schneid. *P. Bôlan*, Hort. *P. Mâsu*, Hort.). JAPANESE PLUM. Fig. 3216; also Figs. 3073, 3074. Strong-growing small tree, with smooth often shining reddish or cinnamon-brown twigs: lvs. mostly oblong-obovate, abruptly but prominently pointed, closely obtuse-serrate, the veins looping near the margin, bright often shining green above and dull beneath: fls. few from each bud (most commonly about 3), showy, white or very nearly so, slender-stalked: fr. various, mostly large and firm, yellow or light red (never blue-purple) with pronounced suture and tending to be pointed at the apex. R.H. 1895:160. Gn. 78, p. 195.—Chinese, but intro. into this country from Japan (in 1870), and now widely distributed and much grown for its fr. The Japanese plum is hardy, in some of its varieties, as far north as Ottawa. It is prized because of its great productiveness, long-keeping qualities and beauty of its fr., and its greater immunity from black-knot. As a class, the fr. is of lower quality than the domestica plums. The season of the Japanese plums begins considerably in advance of the domestica and holds nearly as late. The greater number of the varieties are clingstones, but there are some freestones among them. A race of hybrids with *P. hortulana* and *P. angustifolia* is now appearing.

Var. *pûbipes*, Bailey (*P. triflora* var. *pûbipes*, Koehne). Pedicels densely pubescent or only rarely subglabrous: calyx-tube pubescent a third or half the length.—Cult. abroad.

10. *gymnodonta*, Koehne. Shrub, with crowded unarmed branches: lvs. large and more or less fascicled, conduplicate in veneration, narrow-obovate or obovate-oblong, about 2-3 in. long, at base acute or cuneate; at apex short-acuminate and very acute, serrate with glandless teeth, glabrous or slightly hairy beneath; stipules linear or nearly filiform, often cut: fls. appearing with the lvs., white; calyx-lobes oblong and obtuse, entire or nearly so; petals spatulate-obovate, short-clawed, about 1/2 in. long: fr. not described. Manchuria. Cult. abroad.—From *P. salicina* (*P. triflora*) this species differs in the conduplicate lvs., which are little involute

on margin, glandless lf.-serratures, very short pedicels and smaller fls.

11. *thibetica*, Franch. Ornamental tree, 15-20 ft., with blush-pink fls., and with convolute lvs. which are oblong and obtuse, crenate, the teeth glandular-callose at their apex: fls. with the lvs., on pedicels $\frac{1}{4}$ - $\frac{3}{4}$ in. long, blush-pink; petals $\frac{1}{2}$ in. or less long, scarcely equaling the stamens. W. China, in thickets.

12. *Simonii*, Carr. (*Persica Simonii*, Decne.). SIMON or APRICOT PLUM. Fig. 3217. A straight-growing fastigate tree: lvs. rather long-oblancoelate or lance-obovate, somewhat thick and heavy, dull, very veiny below, finely but unevenly obtuse-serrate, conduplicate or trough-shaped in habit: fls. nearly white, on short stalks, often 2 or 3 together, preceding the lvs.: fr. 1-2 in. diam., flattened lengthwise, very firm in texture, perfectly smooth, handsome maroon-red, possessing a deep suture, the yellow flesh closely adhering to the small spongy-roughened nearly orbicular pit; peduncle usually not adhering to the mature fr. Named in honor of Eugene Simon, who sent pits from China to France, prior to 1872; botanical position in the genus doubtful, as it has some of the characters of apricots. The fls. are sometimes described as appearing with the lvs., but in N. Y., at least, they are distinctly precocious. China. Not known as a native plant. R.H. 1872:110. Gn. 70, p. 225.—Intro. into the U. S. about 1880, or shortly after. Although much advertised by nurserymen, it has not attracted great attention from fruit-growers in the E. On the Pacific slope it is popular. The fr. is usually bitter, with an almond-like astringency, but sometimes it is very palatable. The tree is very hardy and vigorous somewhat north of the limit of peach-growing, but, except in the Pacific region, it does not appear to be uniformly productive. The fr. is handsome, with a pleasing odor and it keeps a long time. The tree is conspicuous for its narrow erect growth. The fls. are borne on short spurs on wood 2 and more years old; also singly on the last year's growth. The Wickson plum is apparently a hybrid of this species and *P. salicina*.

BBB. Group of American or native plums: lvs. relatively narrow and smooth, and the young growth glabrous (*P. subcordata* and *P. americana* partial exceptions), the fr. comparatively small and in shades of yellow and red, not deep blue-purple: fls. mostly more than 3 (sometimes 2) from each bud in the cluster

C. Lvs. mostly broad and thick, pubescent or roughish beneath, very sharply serrate or even jagged: fr. thick-skinned.

D. Shape of lvs. mostly oval to orbicular, and usually obtuse: far western.

13. *subcordata*, Benth. PACIFIC PLUM. Small tree or bush, usually only a few feet high, but sometimes rising to 20 or 25 ft.: lvs. round-ovate, or orbicular, obtuse, mostly broad or subcordate at base, either sharply or obtusely serrate (usually incised-serrate), thick, soft-pubescent beneath but becoming more or less glabrous: fls. white fading to rose, less than 1 in. across, in clusters of 4 or less and appearing before or with the lvs.: fr. globular or short-oblong, usually dark red, in the largest wild forms somewhat over 1 in. diam., the flesh subacid and clinging to the flat, smooth, or slightly roughened stone. High lands and mountains, Calif. and Ore. S.S. 4:154.—The fr. is gathered for domestic uses, and the tree is sometimes planted about settlements. It varies much, and the greater part of the trees do not produce agreeable fr. In many cases it is only a tree-like bush. The bark is blackish, and is sometimes pubescent on young shoots, which are reddish.

Var. *Kelloggii*, Lemmon. Sisson PLUM. Taller and more slender: bark ash-gray: lvs. usually not cordate,

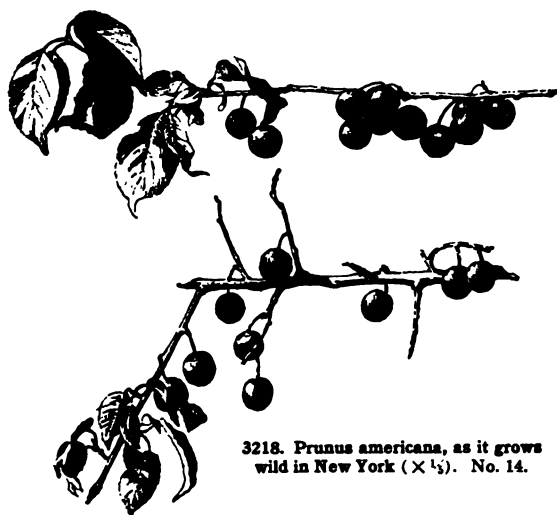
orbicular or elliptical, nearly glabrous, but apparently not constantly different from the species itself: fr. larger (1 in. or more long), ovate, yellow or red, the flesh soft and palatable. N. Calif.—Much recommended by Mr. Sisson, near Mt. Shasta, whose name it bears, and now planted in some places in Calif. It is superior to *P. subcordata*. The tree rarely exceeds 15 ft. in height and 4-6 in. diam. of trunk. It seems to lack good botanical characters of separation from the type of the species.

Var. *oregana*, Wight (*P. oregana*, Greene). OREGON PLUM. Fr. pubescent at maturity: lvs. oval or ovate, not so large as usual in the type species, pubescent at least beneath. Ore.—Apparently not cult.

DD. Shape of lvs. on the ovate or oblong order, mostly acuminate: the Americana set, mostly with lvs. large in proportion to size of plant.

E. Stature of trees: lvs. and fls. large.

14. *americana*, Marsh. (*P. latifolia*, Moench. *P. hiemalis*, Michx., at least in part. *P. ignota*, Nels.). COMMON WILD PLUM. Figs. 3218, 3219; also Figs. 3075, 3076. Small twiggy spreading usually thorny tree



mostly forming thickets, with gray branches or gray-brown twigs: lvs. obovate, oblong-obovate or sometimes oblong-ovate, acuminate, thickish, the margins mostly sharp-serrate or sometimes almost incised, not glossy, strongly reticulated beneath and pubescent on the veins: fls. large, white, slender-stalked, the calyx-lobes entire and pubescent on the inside, appearing in small clusters in advance of the lvs.: fr. various, but mostly small and hard, the skin tough and glaucous and not shining, yellow and variously overlaid with red; stone turgid. Woods and copses. Mass. and N. Y. to Man., Utah, and New Mex., and in the E. to Savannah, Ga., and nearly to the Gulf; the most widely distributed of the native true plums. It sometimes reaches a height of 15-20 ft. S.S. 4:150.—In the E., the frs. are usually austere, and often not fit for eating; but in the W., edible-fruited forms are found in abundance. It is the most prolific source of cult. native plums for the cold N., giving rise to such varieties as Blackhawk, Cherokee, Craig, Forest Garden, De Soto, Golden Queen, Gaylord, Rollingstone, Newton, Hawkeye.

Var. *mollis*, Torr. & Gray (*P. lanata*, Mack. & Bush. *P. americana* var. *lanata*, Sudw.). Lvs. and shoots soft-pubescent or sometimes almost tomentose. Ill., Iowa, Mo.—To this form belong the Wolf, Van Buren, Quaker, and American Eagle plums. There is also a double-fl. variety.

15. *nigra*, Ait. (*P. borealis*, Poir. *P. mollis*, Torr. *P. americana* var. *nigra*, Waugh). CANADA PLUM. Lvs. mostly broader, the teeth glandular and remaining on mature lvs. as small callous points, but the teeth otherwise nearly or quite blunt and thereby differing from the sharply and deeply serrate lvs. of *P. americana*;



3219. *Prunus americana*.—The Weaver (X $\frac{3}{4}$). No. 14.

petioles bearing 2 glands, near the top; fls. larger, on slender dark red pedicels, white changing to pink, the calyx-lobes glandular-serrate and glabrous on the inside: fr. mostly somewhat oblong and orange-red, the stone large and much compressed. New Bruns. to Assiniboia, and in New England, N. Y., Mich., Wis., and N. Ohio; possibly intro. in some of its southern ranges. S.S. 4:149.—A more showy tree than *P. americana*, blooming earlier, and in its extreme forms appearing to be very distinct. It has given rise to some of the best fr.-bearing varieties, such as the Cheney, Itasca, Oxford, Aitkin, Crimson, although not nearly so prolific of cult. forms as *P. americana*.

16. *mexicana*, Wats. (*P. australis*, Muns. *P. reticulata*, *P. tenuifolia*, *P. polyandra* and *P. arkansana*, Sarg.). BIG-TREE PLUM. The southern representative of *P. americana*, as *P. nigra* is the northern: it is tree-like, not sprouting from the roots or forming thickets: lvs. oblong-obovate to obovate, 3–5 in. long, rounded or subcordate at base, abruptly acuminate at apex, sharply and sometimes doubly serrate, short-pubescent above at least when young and long-pubescent beneath (and often confused with *P. americana* var. *mollis*); petiole usually bearing 1 or more short-stalked glands at or near the apex: fls. $\frac{3}{4}$ in. across, white, in small nearly sessile umbels, the pedicels usually glabrous; calyx-lobes mostly reflexed, nearly or quite as long as the tube, dentate at apex or sometimes entire, obscurely glandular, pubescent within; petals variable in shape, usually pubescent and mostly entire: fr. globose or rarely oblong, sometimes 1 in. or more diam., purplish red with bluish bloom; pit or stone obovoid or nearly globular, turgid, the surface smooth or essentially so. S. W. Ky. and W. Tenn. to Okla. and Mex.—Wild fr. is sometimes gathered, and it varies in size and quality, but the species has received little attention horticulturally, although used experimentally as a stock to which its non-suckering habit adapts it. It is said that a hybrid has been produced with *P. salicina*. Wight, who has recently re-characterized this species, writes that "Although long confused with *Prunus americana*, and in the herbarium sometimes difficult to distinguish from *P. americana* var. *lanata*, the species is

nevertheless a very distinct one. It never forms thickets, as does *P. americana* and its subspecies, but occurs always as a tree with a well-defined trunk, which in the older trees differs in its furrowed bark. The young leaves as they appear are mostly somewhat obtuse at the apex instead of acuminate; the older leaves are usually broader in proportion to their length, and the serration of the margin is slightly less pronounced. The flowers also have petals somewhat broader in proportion to their length than in *P. americana*, while the stone is obovoid or round and more turgid."

17. *hortulana*, Bailey (*P. hortulana* var. *Waylandii*, Bailey). HORTULANA PLUM. Fig. 3220. Tree distinct, not sprouting

from the root or forming thickets or hedges, 15–30 ft. tall, with thinnish exfoliating bark and brownish twigs: lvs. oblong-obovate or elliptic-ovate, the blade 3–4 in. long, rather broad to rounded at the mostly oblique base, long-acuminate, yellowish green, glabrous above and more or less shining, lightly pubescent or practically glabrous beneath, the margins shallowly and obtusely serrate or crenate-serrate; petiole usually bearing 1 or 2 or more small glands toward the apex: fls. preceding the lvs., white, small (about $\frac{1}{4}$ in. broad), the pedicels slender and glabrous; calyx-lobes about as long as the tube, oblong-ovate, glandular on margin but otherwise glabrous or nearly so on exterior, mostly obtuse; petals oval to nearly orbicular, clawed:

fr. globose or short-oblong, $\frac{3}{4}$ –1 in. diam. in the wild, red to yellow and mostly white-dotted, with little or no bloom, not thick-skinned; pit or stone various, globose to oval or oblong, the surface more or less reticulated. Cent. Ky., Tenn., to Iowa and Okla.—This species has yielded a good number of cult. varieties, as Kanawha, Golden Beauty, Cumberland, Leptune, Wayland, Moreman, Sucker State. The species was first distinguished in 1892 to designate varieties of plums intermediate between *P. americana* and *P. angustifolia* (the two species at that time clearly separated); these intermediate varieties were then said to "represent at least two other species, and perhaps even more" (G.F. 5:90), one of which it was proposed to separate as *P. hortulana*. Later students have separated *P. Munsoniana* from these varieties, and have redefined other species. Subsequently it was supposed that *P. hortulana* represents a range of hybrids between *P. americana* and *P. angustifolia*, and it is not yet known what part hybridization has played in the origin of these forms, although the evidence accumulates that separate specific types are involved.

Var. *Mineri*, Bailey, is nearer to *P. americana*, and represents the northward extension of the group; it is known by its thicker and duller lvs. which are very veiny below and coarsely toothed and somewhat obovate in outline, and by a late firm fr.



3220. *Prunus hortulana* (X $\frac{1}{2}$). No. 17.

To this form belong the Miner, Langsdon, Clinton, Forest Rose. The Miner is apparently the first horticultural variety of native plum to receive a name; the seed that produced the original tree was planted in 1814.

EE. *Stature of bushes: lvs. and fls. small: far S. W.*

18. *rivularis*, Scheele (*P. texana*, Scheele). CREEK PLUM. Slender-stemmed shrub to 8 ft., forming thickets, with gray or reddish twigs and early-ripening fr. (June):



3221. *Prunus angustifolia* var. *Watsonii* ($\times \frac{1}{2}$). No. 20.

lvs. ovate to oblong-ovate or somewhat obovate, rounded at base, short-acuminate at apex, 1-3 in. long, glandular-serrate, glabrous above, more or less pubescent beneath; petioles with 1 or 2 glands near apex, or glandless: fls. white, with the lvs. or before them, less than $\frac{1}{2}$ in. broad, on slender glabrous pedicels; calyx-lobes as long as tube, ovate or oblong-ovate, usually pointed, glandular, little pubescent on exterior, with age reflexed; petals obovate-orbicular or oblong-obovate, short-clawed: fr. nearly globose, $\frac{1}{2}$ in. or somewhat more diam., red and with light bloom; pit or stone oval to subglobose, the surface smooth or obscurely roughened. Texas.—Apparently of little horticultural value, as the fr. is small and poor, although eaten by Indians. No improved varieties are reported.

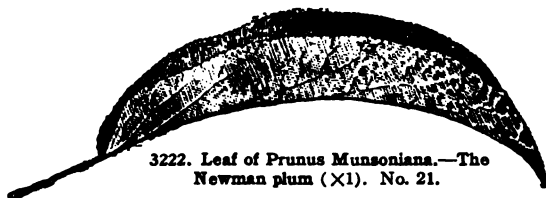
19. *Réverchonii*, Sarg. (*P. pygma*, Muns., not *P. pygmæa*, Willd.). HOG PLUM. Shrub, 2-6 ft., with gray bark and chestnut-colored twigs, forming dense thickets and yielding late-ripening fr. (Aug., Sept.): lvs. ovate-lanceolate (sometimes lanceolate), acuminate, usually 3 in. or less long, strongly conduplicate, either rounded or narrowed at base, glandular-serrate, glabrous and green above, pale and somewhat pubescent beneath; petiole bearing 2-4 glands near apex: fls. with the lvs. or preceding them, white, less than $\frac{1}{2}$ in. broad, on glabrous pedicels; calyx-lobes oblong or ovate-oblong, obtuse, glandular; petals obovate to oblong-obovate, narrowed or somewhat clawed, entire, or erose near apex: fr. globose or nearly so, sometimes nearly 1 in. diam., usually yellow (rarely red) and blushed with orange or crimson and marked with whitish dots, with little or no bloom; stone oblong, the surface smooth or slightly reticulate. Okla., Texas.—No horticultural varieties of this species are recorded; its fr. is sometimes good, although usually poor. Said to be well adapted to limestone soils and to withstand drought. Wight writes that the species is closely related to *P. rivularis* and may be a form of it. "The apparent differences are its more branching and less slender stems, trough-shaped leaves, later-ripening fruit, and more pointed stone."

cc. *Lvs. mostly narrow and peach-like, firm, and more or less shining, glabrous, the young growths not pubescent: fr. thin-skinned: the Chickasaw and Wild Goose sel.*

20. *angustifolia*, Marsh. (*P. Chickasaw*, Michx. *P. stenophyllus*, Raf.). CHICKASAW PLUM. MOUNTAIN CHERRY. Small bushy-topped twiggy tree, 8-10 ft. high or often only a shrub forming dense thickets, with slender zigzag reddish branches: lvs. lanceolate or oblong-lanceolate and conduplicate (trough-like), shining, 2 in. or less long, mostly narrowed toward base, at apex acuminate or short-acute, glabrous or sometimes sparingly pubescent on nerves beneath, finely and closely serrate; petiole glandular or not near apex: fls. white, preceding lvs., about $\frac{1}{2}$ in. across, on glabrous pedicels; calyx-lobes ovate-obtuse and shorter than tube, not glandular, exterior glabrous: fr. small and early, cherry-like, slender-stemmed, red or yellow and yellow-dotted, shining, thinly glaucous, the flesh soft and juicy and clinging to the small rough stone. Del. to Fla. and Texas, being abundant in sandy places. S.S. 4:152.—This species has given rise to several pomological varieties, as Caddo Chief and Ogeechee; it is an early-fruited species, more or less thorny.

Var. *Watsonii*, Waugh (*P. Watsonii*, Sarg.). SAND PLUM. Fig. 3221. Bush, 3-6 ft. high, with more zigzag twigs than in *P. angustifolia*, more spiny, the lvs. smaller, less pointed and less conspicuously serrate, the fls. smaller, the fr. with thicker skin. Dry regions of Kans. to Texas and New Mex. (also reported from Neb. but perhaps intro.), and planted by the settlers, who prize it for its fr. G.F. 7:135 (adapted in Fig. 3221). Several named pomological varieties issue from this variety, as Strawberry, Welcome, Red, Yellow, and Purple Panhandle. Var. *Watsonii* is named for Dr. Louis Watson, of Kans.

Var. *varians*, Wight & Hedr. BIG CHICKASAW PLUM. Rather larger than *P. angustifolia* itself, more robust and a less crabbed grower, lvs. and pedicels longer, and stone usually more pointed at apex. Okla., Texas, in more fertile soil than the species.—Apparently a range of forms growing under better conditions than those in which the plants taken as the type of *P. angustifolia* are found, and giving rise to many early-fruited plums, such as Yellow Transparent, Emerson,



3222. Leaf of *Prunus Munsoniana*.—The Newman plum ($\times 1$). No. 21.

Coletta, Clark, African. Supposed to have furnished hybrids with *P. Munsoniana* and *P. salicina*. The Marianna most probably represents a cross between some form of *P. angustifolia* (perhaps var. *varians*) and *P. cerasifera*.

21. *Munsoniana*, Wight & Hedr. WILD GOOSE PLUM. Figs. 3222, 3223; also Figs. 3076, 3077. A range of forms separated out of the old Hortulana class, of larger and freer growth than the variants of *P. angustifolia*, hardier, with larger and more pointed lvs., and larger fls. bearing glandular calyx-lobes: forming thickets, reaching 20-25 ft. in height: lvs. 3-4 in. long, lanceolate to oblong-lanceolate, rounded at base, at apex acute or acuminate, margins closely glandular-serrate, shining and glabrous, usually slightly pubescent on veins beneath; petioles usually with 2 glands near apex: fls. white, $\frac{1}{2}$ in. or more broad, either with the lvs. or preceding them, on slender glabrous pedicels; calyx-

lobes ovate-oblong to oblong, obtuse, equaling the tube, glandular on margin, mostly glabrous on exterior: fr. globular or oval, bright red or yellowish and marked with whitish dots, late-ripening; pit or stone mostly oval, pointed at apex, the surface usually roughened. Ky. and Tenn. to Miss., Texas, Mo., and Kans.—The botanical status of this group is yet doubtful, although well marked in some forms. From it have come many pomological forms, as Wild Goose, Newman, Milton, Robinson, Pottawattamie, Osage, Whitaker, Jewell, and Texas Belle.

ccc. *Lvs. mostly as narrow as lanceolate-ovate, or else small and shortish, thin or thinnish (except P. maritima), finely and usually evenly serrate, becoming glabrous or nearly so (except in forms of P. umbellata and P. maritima), beneath at maturity: fr. mostly thick-skinned. Species of the beach plum or P. maritima group, mostly plants of low growth and dwarf habit.*

22. *orthosépala*, Koehne. Fig. 3224. A much-branched spreading bush about 4 or 5 ft. high, with young branchlets chestnut-colored: lvs. oblong-lanceolate to obovate-lanceolate, about 2 in. or less long, narrowed at base, at apex acute or acuminate, glabrous and shining, serrate; petiole glandless or with 1 or 2 glands near apex: fls. white, or pink with age, about $\frac{1}{2}$ in. broad, on glabrous pedicels; calyx-lobes oblong-obtuse, ciliate on margins, glabrous or nearly so on the exterior: fr. late, globose, about 1 in. diam., red, white-dotted, with bloom; stone oval, rounded at apex and slightly pointed at base, the surface somewhat rugose.—Not clearly known in the wild, but probably from Kans. to Texas. The Laire, grown in Kans. for the fr., is perhaps to be referred here. The species was founded on plants grown in the Arnold Arboretum from seeds said to have been sent from S. Texas. G.F. 7:187 (reduced in Fig. 3224).

23. *alleganiensis*, Porter. ALLEGHANY PLUM. Fig. 3225. Tree, 12–15 ft., or oftener a straggling bush, usually not thorny, the young growth reddish and glabrous: lvs. lance-ovate to elliptic-obovate, about 3 in. and less long, prominently acuminate, sharply fine-serrate, pubescent on the veins beneath but becoming glabrous with age; petiole usually glandless but sometimes with glands at apex: fls. small ($\frac{1}{2}$ in. across), white, in clusters of 2–5, appearing with or before the lvs., the calyx minutely pubescent and with narrowly oblong-ovate slightly hairy lobes, the petals round-obovate: fr. globular or ovoid, $\frac{1}{2}$ in. or less diam., dark purple with a heavy bloom, acid in flavor and often austere;



3223. *Prunus Munsoniana*.—The Wild Goose plum ($\times \frac{1}{2}$; stones $\times \frac{3}{4}$). No. 21.

stone somewhat obovoid and obtusish at apex, the surface slightly roughened. Pa., Conn. S.S. 4:153. G.F. 3:429, from which Fig. 3225 is reduced.—In a very limited way the species has come into botanic gardens and collections. As an ornamental subject it has merit, for it bears profusely of fls. and fr. The plums, or



3224. *Prunus orthosépala* ($\times \frac{1}{4}$). No. 22.

“sloes,” are collected from the wild for the making of pies and preserves.

Var. *Davisii*, Wight, along gravelly ridges in the northern part of the southern peninsula of Mich., bearing blue frs. used locally for jellies and preserves, is distinguished by lvs. broader in proportion to their length and less acuminate. From *P. maritima*, which it resembles, it differs in the reddish color of twigs, more glabrous lvs. and pedicels, and the stone pointed rather than rounded at base.

24. *umbellata*, Ell. BLACK SLOE of the S. Twiggy small tree (10–20 ft.), with compact head and very slender glabrous branchlets, often more or less thorny: lvs. small (mostly 2 in. or less long), light green and rather thin, oblong, lanceolate, oblong-lanceolate or oval, obtuse or acute, closely serrulate, sometimes very closely pubescent beneath even at maturity; petiole without glands: fls. small to medium in size ($\frac{1}{2}$ – $\frac{3}{4}$ in. broad), white, on slender glabrous pedicels in few-fl. umbels, appearing with or just before the lvs.: fr. small, globular, slender-stalked, from pure yellow to orange-yellow and red-blotched, thinly glaucous, the flesh usually sour and bitter and free from the oval or subglobose stone. Near the coast from S. C. to Fla. S.S. 4:155.—Not intro. as a fr.-plant, but sometimes planted for the profusion of its white fls. The fr. is not unlike a cherry in shape, and is sometimes used in preserves. The foliage suggests *P. cerasifera*.

Var. *injucúnda*, Sarg. (*P. injucúnda*, Small. *P. mitis*, Beadle). A hill-country form: lvs. oval or oblong-oval, usually somewhat longer and broader than in *P. umbellata* itself, narrowed toward the base, acute or acuminate, mostly pubescent beneath and somewhat pubescent above: fls. appearing later (March, April); calyx pubescent rather than glabrous. N. C. to Ga., Ala., and Miss., apparently passing into var. *tarda*.

Var. *tárda*, Wight (*P. tárda*, Sarg.). Tree, 18–20 ft., distinguished from *P. umbellata* by lighter-colored bark, later-ripening fr., and more oblong stone. W. Miss. to Texas and S. Ark., the nearly globular, yellow, red, purple, or blue fr. (about $\frac{1}{2}$ in. diam.) ripening in Oct. and Nov.

25. *maritima*, Marsh. (*P. pygmæa* and *P. sphærica*, Willd. *P. sphærocárpa*, and *P. acumináta*, Michx.



3225. *Prunus alleghaniensis* ($\times \frac{1}{2}$). No. 23.

P. pubescens, Pursh. *P. littoralis*, Bigel. *P. pubigera*, Steud.). BEACH PLUM. SHORE PLUM. Fig. 3226. Decumbent straggling more or less thorny bush with rough and warty branches and slightly pubescent young growth: lvs. oval or obovate-oval, short-acute or nearly obtuse, closely serrate, dull green, often somewhat pubescent beneath: fls. small, white, slender-stalked, borne in few-fl. umbels preceding the lvs.: fr. about $\frac{1}{2}$ in. diam., depressed-globular (somewhat flattened at the ends), with a slight cavity about the st., mostly deep dull purple when ripe and covered with a heavy bloom, the flesh brittle and mostly sweet and juicy and free from the small turgid cherry-like stone (which is pointed at both ends), the skin thick, tough, and more or less acrid. Sands of the seashore, New Bruns. to Va., and also some miles inland; its reported occurrence at the head of Lake Michigan has not been verified. B.M. 8289. Gng. 4:257 (bush in bloom).—The main sts. are decumbent, and strong shoots stand upright to a height of 2–6 ft., or sometimes even 10–12 ft. *P. maritima* is a handsome plant in cult. because of the great profusion of its early spring bloom, and the frs., when produced, are also ornamental. As a fr.-plant, it is known in the variety Bassett American, which, however, has never become popular because of its small size. The species is very variable, and no doubt several botanical varieties could be distinguished. Yellow-fruited forms are known (forma *fláva*, G. S. Torr.). A species related to *P. maritima*, but not in the trade, is *P. Grævesii*, Small, with orbicular very obtuse and often apiculate lvs. and stone pointed only at base. Known only from the original locality at Groton, Conn., near Long Island Sound, an unarmed bush about 3 ft. high, with a dark rather rough bark and usually puberulent twigs.

26. *gracilis*, Engelm. & Gray. OKLAHOMA PLUM. A straggling shrub, closely allied to *P. maritima*, in clumps or thickets, 1–4 ft. high, with grayish bark and reddish brown pubescent young twigs: lvs. oval or ovate, rarely ovate-lanceolate, 1–2 in. long, narrowed either way but sometimes obtusish at apex, finely but lightly pubescent above, strongly pubescent beneath, finely serrate; petiole glandless or with 1 or 2 glands near apex: fls. preceding the lvs., white, $\frac{1}{4}$ to nearly $\frac{1}{2}$ in. broad, on pubescent pedicels; calyx-lobes ovate and acute, entire or denticulate, glandless: fr. globular or ovoid, $\frac{1}{2}$ – $\frac{3}{4}$ in. diam., mostly red and with light

bloom; pit or stone oval, somewhat obtuse at the ends, the surface nearly smooth. W. Ark., Okla. and N. Texas, in dry sandy places.—This species appears to have yielded no named pomological varieties, although the fr. is sometimes collected from the wild for market. *P. venulosa*, Sarg., is a larger shrub, forming denser thickets, with larger and more coarsely serrate lvs. and glabrous pedicels. It is from N. Texas, but whether a good native species or a hybrid of *P. gracilis* and *P. Reverchonii* is undetermined; of no horticultural promise.

Subgenus II. AMYGDALUS. Almonds and Peaches.

Fr. sessile, large, mostly pubescent: fls. solitary from lateral buds on the previous year's growth, appearing in advance of the lvs., the latter conduplicate in the bud.

A. Plant low and bushy as seen in cult.: flowering almonds.

27. *triloba*, Lindl. (*Amygdalus pedunculata*, Bunge. *Amygdalopsis Lindleyi*, Carr. *Prunopsis Lindleyi*, André. *Prunus ulmifolia*, Franch.). FLOWERING ALMOND. (See Nos. 39, 40.) Fig. 3227. Lvs. broadly ovate or obovate, usually broader above the middle, soft-hairy, abruptly pointed, coarsely doubly serrate, tending to be 3-lobed above: fls. solitary, short-pedicelled, and mostly in advance of the lvs., clear pink, sometimes white, usually double (var. *plena*, Hort. Fig. 3234); calyx-tube hairy inside between stamens, the sepals pilose or glabrous on outside; sepals and petals (in single fls.) 5–10: fr. small, red-hairy when young, but becoming glabrous. China. B.M. 8061. I.H. 8:308. F.S.15:1532. R.H. 1862:91; 1870, p. 388 (fr.); 1883, p. 367 (fr.); 1884:396; 1907, pp. 154, 155. Gn. 21, p. 275; 28:346; 55, p. 374; 59, p. 135; 79, p. 17. G.M. 44:210; 52:247. G. 26:462; 33:19. H.F. II. 7:139. Gng. 5:165; 6:289; 8:196.—A most desirable bush, hardy in Cent. N. Y. and Ont. It is a good subject for blooming in pots. It is sometimes grown as a standard worked on plum, but it is then short-lived; better results are to be expected from own-rooted plants (by layering or root-grafting). Sometimes it rises to the stature of a small tree. The double-fl. form (var. *plena*) is the one commonly seen in grounds, but the single-fl. form is the better. A sport producing several pistils has been recorded (*Amygdalopsis*). Not to be confounded with the forms of *P. japonica* and *P. glandulosa*, which have smaller and relatively longer-stalked fls. and usually more than 1 from the bud, and different lvs.

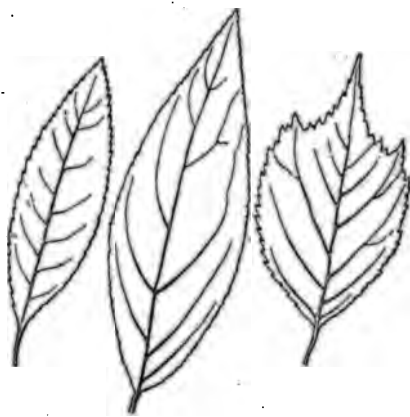
Var. *Pétzoldii*, Bailey (*P. Pétzoldii*, Koch. *P. virgata*, Hort.). Branchlets and adult foliage glabrous: lvs. ovate or elliptic, usually at or below the middle, not 3-lobed, gradually narrowed or acuminate above, glabrous, with narrow sharp teeth: fls. smaller than in *P. triloba* and with shorter pedicel, rose-colored; calyx-tube glabrous inside as are the lobes or sepals on the



3226.
Prunus maritima
($\times \frac{1}{2}$). No. 25.

outside, the sepals and petals usually 10: fr. spherical; stone hard, bony and more rugose. Probably China.

28. *orientalis*, Koehne (*Amygdalus orientalis*, Mill. *A. argentea*, Lam.). ORIENTAL ALMOND. Shrub, 3-10 ft. high, with woolly twigs: lvs. small ($\frac{3}{4}$ -1 $\frac{1}{2}$ in. long), nearly or quite sessile (petiole less than $\frac{1}{2}$ in. long), oval, oblong or narrow-obovate, nearly obtuse or short-



3227. Dwarf almonds. *Prunus nana* at left; *P. glandulosa* in middle; *P. triloba* at right in the lobed form that sometimes occurs on spring or strong shoots. (\times about $\frac{1}{2}$)

pointed, entire or obscurely serrulate: fls. solitary, nearly 1 in. across, light rose-color, with or just preceding the lvs.: fr. ovate or oblong, more or less pointed, thinly pubescent but becoming glabrous. Asia Minor, Syria. L.B.C. 12:1137.—Variable; several species-names of the same general geographical region are probably to be referred to it, or they may represent very closely related species.

29. *nana*, Stokes (*Amygdalus nana*, Linn.). RUSSIAN ALMOND. Fig. 3227. Bush, 3-5 ft. high: lvs. narrowly elliptic or elliptic-lanceolate, 2 or 3 in. long, thick and rather stiff, scarcely pointed, lighter colored and the veins prominent beneath, smooth, the edges set with sharp spreading saw-like teeth: fls. usually solitary, rose-color or white, nearly 1 in. or less across, sessile, with or just preceding the lvs.: fr. small and hard, pubescent, bitter, with a large wrinkled sharp-pointed somewhat cordate, unequal-sided pit. Russia and W. Asia. B.M. 161. L.B.C. 12:1114.—This plant has been intro. into this country recently as a fr.-plant, although it possesses little merit for that purpose. It is cult. in Eu. for its fls. and it has been thought that the flowering almond of our gardens belongs to it; but our flowering almonds are *P. triloba* and also in part *P. glandulosa* and *P. japonica*. This Russian almond is very hardy, enduring the climate of the northern Prairie states, where it ripens its little almond-like frs. in July. A small-fruited form of the apricot (*P. Armeniaca*) has been intro. as Russian almond. *Prunus nana* is cult. in 2 or 3 forms. Var. *campéstris*, Hort., has white fls. of larger size. Var. *georgica*, DC., has dark rose-colored somewhat smaller fls. and narrower, longer lvs. Var. *cochin-chinensis*, Hort., is a larger plant with white fls. Var. *rubra*, Hort., has red fls. over $\frac{1}{2}$ in. across. G.C. III. 52: suppl. Nov. 23 (1912). For another use of the name *P. nana* (for the choke cherry), see No. 72.

30. *Sweginzowii*, Koehne. Small glabrous shrub very like *P. nana*, distinguished by large and lf.-like stipules and unequal very sharp double teeth of the lvs.: fls. deep rose-colored; calyx tubular, nearly $\frac{1}{2}$ in. long, the lobes oblong and glandular-fimbriate; petals oblong-obovate with cuneate base, nearly $\frac{1}{2}$ in. long. Turkestan.

31. *Fenzliana*, Fritsch. Much like *P. communis*, but lower and more bushy and thorny: lvs. smaller, gray-green or bluish green: fls. more nearly white: fr. more peachlike in form, being not so pointed or elongated as in *P. communis*, but scarcely fleshy; stone shorter and more nearly orbicular in outline. Caucasus.—Said to be a very showy early-blooming species.

AA. Plant a tree or tree-like.

B. Fr. hard, splitting at maturity.

32. *communis*, Fritsch (*Amygdalus communis*, Linn. *Prunus Amygdalus*, Stokes). ALMOND. Figs. 161-163, Vol. I. Peach-like tree, 10-25 ft. tall, with gray bark: lvs. lanceolate, firm and shining, very closely serrate: fls. large (1 in. and more across), solitary and appearing before the lvs., pink, showy: fr. a large compressed drupe with hard flesh, splitting open at maturity and liberating the pitted stone (or almond). Asia. Gn. 50:312 and G. 29:291 (var. *macrocarpa*); Gn. 54:122.—Grown as an ornamental tree, but chiefly for the nuts (pits or stones of the fr.). There are double-fl., white-fl., and variegated-lvd. forms, also dwarf and weeping forms, under such names as *albo-plena*, *roseo-plena*, *purpurea*, *compacta*, *variegata*, *pendula*. The forms may be ranged in two classes: Var. *typica*, Schneid., the hard-shelled almond, grown mostly for ornament, although there are bitter-kerneled and sweet-kerneled forms (vars. *amara* and *dulcis*); var. *fragilis*, Schneid., the soft-shelled or brittle-shelled almond, of which there are also vars. *amara* and *sativa*. See Almond. *P. persicoides*, Asch. & Graebn. (*Amygdalus communis* var. *persicoides*, Ser. *A. persicoides*, Zabel), is an old hybrid of *P. Persica* and *P. communis*, with foliage much like the latter but usually more sharply toothed, and fr. intermediate or perhaps more peach-like, usually ovoid-obtuse and little succulent.

BB. Fr. soft and fleshy, usually not cracking or opening to the stone.

33. *Persica*, Sieh. & Zucc. (*Amygdalus Persica*, Linn. *Persica vulgaris*, Mill.). PEACH. Figs. 2785-2791. Much like the almond in botanical characters and by some thought to be derived from that plant, but now generally agreed to be an original species and to be native to China (Fig. 2791, p. 2495): lvs. broad-lanceolate or oblong-lanceolate, coarsely serrate, the petiole usually gland-bearing and $\frac{1}{2}$ in. or less long (shorter than the width of one side of lf.-blade): fls. solitary, pink, appearing before the lvs., the sepals more or less pubescent on outside: fr. soft, pubescent at maturity, the stone deep-pitted and very hard. Widely cult., especially in N. Amer., where it thrives under a great variety of conditions.—There are 2 well-marked forms, the cling-stones or paves (*Persica vulgaris*, Risso), and the freestones (*Persica domestica*, Risso). There are many ornamental forms of the peach tree: double-fl., Fig. 2789. (F.S. 10:969; 13:1299, 1300. R.H. 1852:221); white-fl., dark-fl., etc.; purple-lvd.; variegated-lvd.; dwarfs. These forms are catalogued



3228. *Prunus Davidiana* ($\times \frac{1}{2}$). No. 34.

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under such names as *Persica vulgaris flore albo-plena*, *flore rosco-plena*, *flore sanguinea plena* representing different colors of double-fl. peach, and *P. vulgaris foliis purpureis* representing the purple- or blood-lvd. peach. One of the best of these fancy forms is var. *camelliaeflora*, Hort., with its subvar. *plena*, the former with very large carmine fls. and the latter with double fls. (Fig. 2789). There are forms (var. *versicolor*) with different colors of fls. on different branches of the same tree; also compact or dwarf, pyramidal, weeping, and purple-lvd. forms. See *Peach*.

Var. *nucipersica*, Schneid. (*Amýgdalus Persica* var. *nucipersica*, Linn. *Persica nucipersica*, Borkh. *Persica lævis*, DC. *Prunus Persica* var. *lævis*, Gray. *Amýgda-*



3229. *Prunus pumila*.—Sand cherry ($\times \frac{1}{2}$). No. 35.

lus nectarina, Ait. *Prunus Persica* var. *nectarina*, Maxim.). NECTARINE. Fig. 2453, p. 2116. Fr. smooth, usually smaller: lvs. usually more strongly serrate. The nectarine is said to have sprung from the peach, both through seed- and bud-variation. There are 2 types, as in the peach: clingstones or *brugnons* (*Persica lævis*, Risso), and freestones (*Persica violacea*, Risso). The nectarine is not generally cult. in this country, although it is popular in Calif.

Var. *platycarpa*, Bailey (*Persica platycarpa*, Decne.). FLAT PEACH. Fr. much flattened endwise, and scarcely thicker in that direction than the length of the pit or stone, with a calyx-like eye or broken cavity at the top; stone small, flat, compressed, rough, and irregular. China. R.H. 1870:111. Trans. Hort. Soc., Lond. 4:512.—Grown in the southern states, where it has given rise to various globular peaches. The Peen-to is a form or variety (Fig. 2784, p. 2493) originated in 1869 with P. J. Berckmans, Augusta, Ga., from seeds sent from Austral., where it was probably intro. from China; on account of its very early blooming, this variety is not grown commercially in any of the regular peach sections of the U. S., as it is very likely to be caught by frosts, nor is the quality superior; for S. Fla. and the tropics, it is of value; the fr. is of medium size, strongly flattened on the ends, greenish, with red cheek, flesh light yellow and of good flavor but with a slight bitter-almond taste, cling, the stone small and flat.

34. *Davidiana*, Franch. (*Persica Davidiana*, Carr. *Prunus Persica* var. *Davidiana*, Maxim.). Fig. 3228. Slender willow-like tree: lvs. narrower and smaller than those of the peach, tapering from near the base into very long acuminate points, very sharp-serrate, light green, willow-like: fls. appearing very early, 1 in. or more across, bluish or light pink, solitary, the sepals glabrous: fr. nearly globular, the suture prominent, about 1 in. diam., pubescent, grayish or yellowish; stone small and nearly spherical, ruminated, free from the whitish dry flesh. China. R.H. 1872, p. 75. G.F. 10:503. Gt. 44:1412. G.C. III. 11:529. Var. *alba*, Bean (var. *albiflora*, Schneid. *Persica Davidiana* var. *alba*, Carr.). Fls. white. Gn. 50, p. 165. G. 28:5. Somewhat grown as an ornamental subject. Hardy in the North, but the fl.-buds are usually killed. It blooms very early, much in advance of peaches. It is

said to be used in China as stock for many stone-fruits, and tests (particularly as a peach stock) are now under way in this country.

Subgenus III. CERASUS. Cherries.

Fr. globular or oblong, not sulcate, glabrous and usually not glaucous, the stone turgid (usually nearly globular), and rarely conspicuously longer than broad and smooth: fls. in umbel-like fascicles (mostly solitary in *P. tomentosa*), commonly with or immediately preceding the lvs.

- A. Fls. arising from 2 lateral buds (the central one usually a lf.-bud or branch-bud) on the previous season's growth, usually appearing in advance of the lvs., the pedicels having no common peduncle outside or beyond the bud-scales: petiole usually very short: plant dwarf. (*Microcerasus*.)
- B. Sepals or calyx-lobes reflexed: fls. pedicelled and umbellate, 4 or less (sometimes only 1).
- C. Lvs. entire at base or below the middle, very shallowly serrate toward the apex: fr. black at maturity.

35. *pumila*, Linn. SAND CHERRY. DWARF CHERRY. Fig. 3229. Decumbent or prostrate at the base when old, but the young growth strictly erect and often reaching 5-8 ft. in height, the slender twiggy growth reddish and glabrous: lvs. narrowly oblanceolate, acuminate, short-pointed or nearly obtuse, the margins above very closely serrate, dull green above and whitish green beneath: fls. small, in 2-5-fl. umbels, the pedicels slender: fr. nearly globular, purple-black, on slender sts. On sandy and rocky inland shores from E. Que. to Man. and south to the District of Columbia; common on sand-dunes along the Great Lakes.—The fr. is small and usually scarcely edible, the flesh being astringent. The species is common on dunes of the Great Lakes. It is in cult. as an ornamental plant, for which it is worthy, although it is much attacked by the twig-blight (caused by the fungus *Monilia*). There are reputed crosses between this species and native plums.

36. *cuneata*, Raf. (*P. pumila* var. *cuneata*, Bailey). Fig. 3230. Erect, 1-4 ft.: lvs. thin, oval, short-obovate or spatulate, strongly toothed, especially at apex: fls. larger. Bogs and cool woods and about lakes in the northern states, and in the mountains as far south as N. C.—Not in the trade, so far as known, and not promising horticulturally.

37. *Bésseyi*, Bailey (*P. pumila* var. *Bésseyi*, Waugh. *P. Rosebudii*, Reagan. *P. prunella*, Daniels). WESTERN SAND CHERRY. Figs. 3231, 3232. Known from *P. pumila* by its more prostrate habit, lvs. spreading (more erect in *P. pumila*), broad and thick, usually elliptic, elliptic-oval, or elliptic-lanceolate: stipules on strong shoots, large and green, serrate: fr. nearly or quite twice larger, on short stalks, usually sweet, in certain selected forms as much as $\frac{3}{4}$ in. diam. This is the sand cherry of the Plains and the W., ranging from Kans. to Man., and west to Wyo. and Colo. B.M. 8156.—The original of the Improved Rocky Mountain cherry, a plant grown for its large sweet fr. Large-fruited forms of this species are much prized on the Plains for pies and other cookery, and the species is promising horticulturally. Many hybrids with other species of *Prunus* have been secured by Hansen. The species is useful as a stock for certain other cherries, plums, and



3230. *Prunus cuneata* ($\times \frac{1}{2}$). No. 36.

even peaches for cold countries where the trees must be protected. See Hansen, Bull. No. 87, S. Dak. Exp. Sta. (1904), and subsequent bulletins.

cc. *lvs. usually serrate or crenate to the base, sometimes double-serrate: fr. red.* Nos. 39 and 40 are the dwarf or "flowering" cherries of gardens, often confused with the flowering almond (*P. triloba*) but distinguished by the longer pedicellate fls. which usually are not solitary from the bud.

38. *utahensis*, Dieck. UTAH HYBRID CHERRY. Apparently a hybrid of *P. angustifolia* var. *Watsonii* and *P. Besseyi*. A small tree-like bush: lvs. lance-elliptic to oblong-oval, short-pointed or nearly blunt, finely serrate, slightly conduplicate, glossy above and much reticulated beneath: fr. cherry-like, somewhat larger than that of *P. Besseyi* (about $\frac{3}{8}$ or $\frac{1}{2}$ in. diam.), of deep mahogany-color, with a thin plum-like bloom, a thin flesh and a relatively large cherry-like stone.—Appears to have been raised about 50–60 years ago from seed of *P. Besseyi* (*P. Watsonii* grew near) by J. E. Johnson, in Nebr. Mr. Johnson subsequently moved to Utah, whence the fr. was distributed. It has little value as a fr.-plant, but it is an attractive ornamental subject, both in fl. and fr.

39. *japonica*, Thunb. (*P. nana*, Hort., in part. *P. sinensis*, Hort., of Amer. gardens). Fig. 3233. Bushy plant,



3231. *Prunus Besseyi* ($\times \frac{1}{2}$). No. 37.

rarely over 5 ft. high: lvs. ovate, ovate-orbicular, or otherwise on the broad order (rarely as narrow as ovate-lanceolate) acuminate or even caudate, not at all inclined to be lobed, coarsely double-serrate or crenate, glabrous beneath or short-hairy on midrib and nerves: fls. in 2's and 3's, rose-colored or bluish, stalked (the stalks lengthening), appearing with the lvs.: fr. globular or short-oblong, $\frac{1}{2}$ in. diam., smooth and shining, wine-red. Cult. from Japan, but probably native to China. To what extent this species is cult. in this country is yet to be determined. It runs into several well-marked forms. Var. *eujaponica*, Koehne. Branches erect and virgate: lvs. short and broad-acuminate, the primary teeth short and obtuse but not truly triangular; blade beneath glabrous at maturity or lightly hairy on rib and nerves, rounded at base: fls. simple (not double). Var. *gracillima*, Koehne. Branches wide-spreading, the branchlets very slender and somewhat deflexed: lvs. long and narrow-caudate, mostly cordate at base, the primary teeth longer and more acute, and exactly triangular: fls. simple (not double), white or rose. Var. *Thunbergii*, Koehne. Mature lvs. glabrous beneath: lvs. long and narrow-acuminate, the teeth truly triangular: fls. pale rose, on pedicels about $\frac{1}{2}$ in. long; petals $\frac{1}{2}$ in. long, the stamens shorter; style sparsely pilose at base. Var. *Engleri*, Koehne. Differs from var. *Thunbergii* in the mature lvs. being short-hairy and the midrib and nerves beneath and pedicels twice or more as long (becoming $\frac{3}{4}$ in. long in fr.): petals $\frac{1}{2}$ in. or more long, pale flesh-color; stamens $\frac{1}{4}$ – $\frac{1}{2}$ in. long; style glabrous or hairy at base. Var. *Kérii*, Koehne. Fls. semi-double, the petals numerous; ovaries usually 2: lvs. glabrous beneath. B.R. 27 and

R.H. 1852: 301 (both as *P. japonica*). B.M. 2176 (as *Amygdalus pumila*).

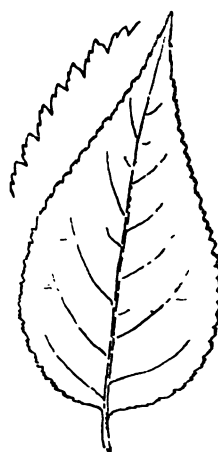
40. *glandulosa*, Thunb. Fig. 3227. Long confused with *P. japonica*, but differing markedly in the foliage: lvs. ovate-oblong, oblong, oblong-lanceolate, or otherwise on the narrow order, little or not at all acuminate



3232. Western sand cherry.—*Prunus Besseyi* ($\times \frac{1}{2}$). No. 37.

but gradually tapering, widest at or below the middle, closely serrulate or crenate-serrate, sometimes in part somewhat doubly serrate, glabrous beneath or slightly hairy along the midrib: fls. about 2 from the bud, slender-stalked (pedicels about $\frac{3}{8}$ in. long at anthesis), bluish, pink or white. China. B. M. 8260 (as *P. japonica*).—*P. glandulosa*, Torr. & Gray (*Amygdalus glandulosa*, Hook.), the "wild peach," a very different plant on prairies in Texas, promising, must take the name *P. texana*, Dietr. (*P. Hookeri*, Schneid.). The *P. glandulosa*, Thunb., assumes many forms. Var. *glabra*, Koehne. Fls. simple or double, white or rose, with glabrous pedicel and style: stipules persistent: lf.-blade glabrous both sides or hairy in the axils of veins beneath: young branchlets pulverulent at base. B.R. 1801, (as *P. japonica*, white-fl.). I.H. 5:183 (as *P. japonica flore albo-plena*). Var. *Párdomii*, Koehne, probably not cult.: differs from var. *glabra* in petioles and pedicels being puberulent: fls. simple; style glabrous. Var. *trichostyla*, Koehne. Fls. single or double, white or rose, the pedicels glabrous or puberulent, style pilose at base: stipules persistent: young branchlets glabrous or pulverulent: fls. white, about $\frac{1}{2}$ in. across. Frequent in cult.; it has been described under such names as *Prunus sinensis*, *P. japonica flore-plena*, and *Cerasus japonica*. The growth is wiry and erect, the branches glossy and purple-brown. Var. *salicifolia*, Koehne. Stipules deciduous: fls. mostly only 1 from a bud: branches erect and virgate, to 3 ft. high, glabrous: lf.-blade narrow, or linear-elliptic, acuminate or acute, simply or doubly serrate. Liao-tung Peninsula; probably not cult.—*P. glandulosa* is a common "flowering almond" of American gardens. It is cult. chiefly in two forms, the double white (var. *glabra forma albiplena*, Koehne), and the double pink (var. *trichostyla forma sinensis*, Koehne). What other botanical forms may be in cult. as flowering almond needs to be determined.

41. *humilis*, Bunge. Erect shrub, 1–4 ft. high, with slender dark brown branches: lvs. 2 in. or less long, elliptic-ovate, somewhat acute, short-petioled, serrulate, bright green above, lighter colored beneath, the linear stipules glandular-ciliate: fls. solitary or in pairs, broadest above the middle, short-peduncled and short-pedicelled, white with red-based petals, $\frac{1}{2}$ in. diam., appearing with the lvs.; calyx-lobes oblong, obtuse, and ciliate, as long as the tube; petals twice exceeding calyx-lobes or sepals, orbicular and crenulate: fr. $\frac{1}{2}$ in. long, ovoid-globose, red. N. China. B.M. 7335.



3233. Leaf of *Prunus japonica* ($\times 1$). No. 39.

BB. *Sepals or calyx-lobes erect or erect-spreading: fls. mostly 1 or 2, pedicels short or none.*

42. *tomentosa*, Thunb. (*Cerasus tomentosa*, Wall.). Small compact but wide-spreading tree, or in Amer. a tree-like bush, the young growths pubescent-tomentose: branches close-jointed, causing the lvs. and fls. to be numerous: lvs. broad-oval to short-obovate, short-stalked, abruptly contracted into a short point, the margins incisely and sometimes unequally serrate, dull and rugose above, densely pubescent-tomentose beneath: fls. white as to petals but with bright red calyx and pedicel, small, sessile, usually 1 or 2 at a joint, appearing just before the lvs. or as the lvs. begin to unfold, from pink buds: fr. light red, globular, the size of a very small cherry, sessile or very short-stalked, sparsely hairy, eaten in Japan. N. China and Manchuria. B.M. 8196. A.G. 12:77. G. F. 5:581.—A



3234. *Prunus triloba* var. *plena*. (Nearly nat. size.) No. 27.

worthy hardy small tree, making a very dense top, and quite unlike most other cherries in appearance. On floral characters the species gives rise to many forms, 2 or 3 of which are in cult. Var. *Spaethiana*, Koehne. Fls. white, appearing with the lvs., and somewhat scattered on the branches, the petals about $\frac{1}{4}$ in. broad; calyx-lobes or sepals somewhat longer than the tube. Var. *Graebneriana*, Koehne, differs from var. *Spaethiana* in the large fls. (petals $\frac{1}{4}$ in. broad) which are crowded, and calyx-lobes about equaling the short-tubular calyx-tube. Var. *endotricha*, Koehne. Lvs. elliptic or oblong, 1–2 in. long, the petiole very short: fls. white, very abundant: fr. about $\frac{1}{2}$ in. long and nearly as broad, dark red, sparingly pilose.—*P. tomentosa* is hardy even in the Dakotas, and improved fruit-bearing races of importance are likely to arise.

43. *incana*, Stev. (*Cerasus incana*, Spach. *Amigdalus incana*, Pall. *A. nana* var. *incana*, Loud.). Slender-twigged shrub of medium size (3–5 ft.): lvs. small, the petiole short and soft-hairy and glandless or bearing glands at the top, the blade about 2 in. long (1–2½ in.), ovate-oblong, elliptic or lance-elliptic, short-pointed or obtuse, finely sharp-toothed, white-tomentose beneath: fls. mostly in 2's, appearing with the lvs. or just in advance of them, light rose-color, about $\frac{1}{2}$ in. across, the petals emarginate, the pedicels not exceeding the bud-scales: fr. bright red, the size of a pea, smooth, juicy. S. E. Eu. and W. Asia. R.H. 1853:281. B.R. 25:58. Gt. 44, p. 243 (lf.).—*P. Maureiri*, Zabel, is a hybrid of *P. incana* and *P. pumila*.

44. *prostrata*, Labill. (*Cerasus prostrata*, Loisel.). Crooked or scraggy shrub to 6 ft., with tomentose somewhat erect or spreading branches: lvs. 1 in. or less long, short-ovate or ovate-orbicular, rarely lanceolate, obtuse, serrate, mostly very white beneath, the petiole short and glandless: fls. mostly single (sometimes fascicled), rose-red, appearing with the lvs., nearly sessile; calyx-tube about $\frac{1}{4}$ in. long, cylindric, pubescent or glabrous, the lobes oblong, obtuse, and entire; petals exceeding calyx-lobes or sepals, very broad: fr. $\frac{1}{2}$ in. diam., ovoid or nearly globular, dry, red-purple. S. E. Eu. and S. W. Asia.

45. *microcarpa*, C. A. Mey. (*Cerasus microcarpa*, Boiss. *P. diffusa*, Schneid.). Shrub of variable habit, 7 ft. or less high, bark dark brown or tawny, branches usually pubescent when young: lvs. small (about 1 in. or less long), broad-ovate or ovate-elliptic or lance-oblong, somewhat acute, serrate, glabrous or somewhat pubescent; petioles very short, thinly pubescent: fls. 2 or few together, about $\frac{1}{2}$ in. across,

pale rose or white, appearing with the lvs. or just preceding them, on pedicels $\frac{1}{2}$ in. or less long; calyx-tube reddish outside. the lobes very short and ovate and ciliate; petals obovate, $\frac{1}{4}$ in. or less long: fr. ovoid, about $\frac{1}{4}$ in. long, red or yellowish. Asia Minor, Persia. B.M. 8360.

AA. *Fls. from a single bud above the lf.-scale, rather than from 2 lateral buds that spring from the scales at the base of the central bud as in A (where the buds are therefore typically in 3's, whereas in AA they are placed singly on the axial growth of the previous year or are clustered on spurs): infl. umbellate and sessile or branching and peduncled: petiole usually long, or at least prominent: plant a tree or tree-like in most species. (Typocerasus.)*

B. *Sepals or calyx-lobes reflexed.*

C. *Lvs. roundish,—nearly as broad as long: fl.-clusters on the ends of the branchlets.*

46. *Mahaleb*, Linn. (*Cerasus Mahaleb*, Mill. *Prunus odorata*, Lam. *Pädus Mahaleb*, Borkh.). MAHALEB CHERRY. ST. LUCIE CHERRY. Small slender tree with hard glabrous branchlets: lvs. 2–3 in. long, light green, round-ovate to orbicular, abruptly very short-pointed, often subcordate at base, the margins closely callous-serrate: fls. small, fragrant, white, in small terminal umbels in May and June (in N. Y.), appearing when the tree is in nearly full leaf: fr. very small, dark red, not edible. Cent. and S. Eu. and the Caucasus.—Extensively imported for cherry-tree stocks, and frequently run wild. There are several cult. forms, as: var. *chrysocarpa*, Hort., with yellow fr. (Gn. 62, p. 181); var. *albo-marginata*, Dipp., with white-edged lvs.; var. *variegata*, Hort., with variegated foliage; var. *pendula*, Hort., with weeping or drooping branches (G.M. 44:210); var. *globosa*, Dieck, with rounded head; var. *compacta*, Hort., with compact condensed head; var. *monströsa*, Kirchn., has very short and thick branches and branchlets; var. *Cupaniäna*, Fiori & Paol. (*P. Cupaniäna*, Guss.), is smaller than the type: lvs. much smaller ($\frac{1}{2}$ to about 1 in. long): peduncles



3235. *Prunus pennsylvanica* (× $\frac{1}{2}$). No. 49.

short, 3–6 fld.: fls. smaller. Sicily. Var. *transilvanica*, Schur. Fls. small, numerous in the cluster; sepals reflexed. Transylvania.

CC. *Lvs. distinctly longer than broad: fl.-clusters mostly lateral.*

D. *Fl.-clusters branching and leafy (with prominently broad lf.-like bracts).*

47. *Maximowiczii*, Rupr. Tree, to 50 ft., with horizontal branches: lvs. obovate or elliptic-obovate, coarsely double-toothed, prominently veined, glabrous, rather short-acuminate, the petiole hairy and glandless and about $\frac{1}{2}$ in. long: fls. white, about $\frac{3}{4}$ in. across, long-pedicelled, appearing with the full foliage on slender open leafy-bracted peduncled clusters, the stalks, broad serrate bracts, and calyx hairy: fr. size of small pea, black. Manchuria, Korea, Saghalin, Japan.—A distinct and attractive species.

DD. Fl.-cluster a small umbel, very short-pedunculate.

48. *pilosidiscula*, Koehne. Shrub, or tree to 40 ft., and a trunk to 16 in. diam.: lvs. obovate or obovate-oblong, some specimens broader, base mostly rounded or emarginate, more or less acuminate, very strongly and often somewhat incisely doubly or simply serrate, the teeth acuminate and glandless or very nearly so, mostly glabrous above and hairy or glabrous beneath; petiole $\frac{1}{4}$ – $\frac{1}{2}$ in. long, slightly hairy or glabrous, with 2 glands at apex or on the base of the blade: fls. with or just preceding the lvs., pink, solitary or mostly 2 or 3 together, the bracts oblong to rotundate and glandular-serrate, persistent, the peduncle very short to $\frac{1}{2}$ in. long, the pedicels $\frac{1}{2}$ to more than 1 in. across; calyx-tube glabrous; lobes triangular, obtuse or acute, glabrous or at the apex sparsely ciliate; petals about $\frac{1}{2}$ in. long, oval: fr. oblong, red. Cent. and W. China. Var. *mèdia*, Koehne, differs in having hairs on the midrib and nerves of the lf. underneath.

DDD. Fl.-clusters sessile, umbellate, not branching.

E. Teeth of lvs. very short or small: native bird cherries, bearing very small white fls. on slender pedicels in naked small lateral umbels, and a profusion of very small red or black frs.

49. *pennsylvànica*, Linn. (*Cérusus pennsylvànica*, Loisel. *C. boreàlis*, Michx. *Prunus boreàlis*, Poir. *P. persicifolia*, Desf. *Cérusus persicifolia*, Loisel.). COMMON WILD BIRD or PIN CHERRY. Fig. 3235. Shallow-rooted tree with slender red-barked branches, 25–40 ft. high and sometimes $1\frac{1}{2}$ ft. in diam. of trunk: lvs. oblong-lanceolate-acuminate, light green and rather thin, closely sharp-serrate: fls. small, white, slender-stalked, appearing with the lvs., in 2's or 3's: fr. the size of a pea, light cherry-red, the flesh thin and sour and somewhat puckery; stone oblong. Sandy and rocky lands, Newfoundland to Brit. Col., and south in the mountains to Colo. and N. C. S.S. 4:156. B.M. 8486. —Where the tree grows naturally, it often sprouts inveterately and becomes a nuisance. When bruised, the wood has a strong peach-like odor. It is an interesting ornamental tree, however. In poor soils, it is often little more than a bush. On large trunks the bark tends to peel in transverse strips. Var. *saximontàna*, Rehd., of the Rocky Mt. region, is shrubby in growth, with smaller and broader pale green lvs. and few-fl. sessile umbels.

50. *emarginàta*, Walp. (*Cérusus emarginàta*, Douglas). Shrub, 3–10 ft. high, sometimes a small tree, forming dense thickets: lvs. oblong-ovate or oblanceolate, mostly obtuse, closely serrate, often somewhat pubescent beneath: fls. tinged green, appearing with the lvs.

in 6–12-ft. glabrous or pubescent corymbs: fr. larger than that of *P. pennsylvànica*, almost black when ripe, the flesh thin and bitter; stone ovoid. Mountains, Brit. Col. to Calif. S.S. 4:157. —Sometimes offered as an ornamental tree.

51. *mòllis*, Walp. (*P. emarginàta* var. *mòllis*, Brew. *Cérusus mòllis*, Douglas). Small tree, reaching 30–50 ft., straight and graceful, with reddish cherry-like bark: young growth soft-pubescent: lvs. 1–3 in. long, obovate to oblong or oblanceolate, mostly acute, serrate, nearly or quite glabrous above, pubescent underneath, the stipules narrow and lacinate: fls. white, in 5–10-fl. clusters; calyx-lobes oblong, obtuse, and entire, becoming reflexed, much shorter than the tube; petals obovate, about 2 lines ($\frac{1}{16}$ in.) long: fr. $\frac{1}{2}$ in. or less long, bright red, very bitter; stone wrinkled, keeled on one edge. Woods, Brit. Col. to Calif.

EE. Teeth of lvs. mostly prominent (exception in No. 52).

52. *fruticòsa*, Pall. (*P. Cérusus* var. *pùmila*, Linn., not *P. pùmila*, Linn., *P. Chamæcérusus*, Jacq. *P. pùmila*, Hort. *P. intermèdia*, Poir. *Cérusus Chamæcérusus*, Loisel. *C. humilis*, Hort. *Cérusus sibirica*, Hort.). DWARF CHERRY, or GROUND CHERRY, of Eu. Spreading bush, 2–4 ft. high, with slender glabrous branchlets: lvs. varying from obovate to oblanceolate and lanceolate, the apex acuminate or sometimes almost obtuse, closely serrulate, thickish, shining above, the petiole short: fls. white, in nearly or quite sessile umbels: fr. small, globular, purple-red, very sour. Highlands and mountains of Germany, Austria-Hungary, and S. Russia. —*P. éminens*, Beck, is a hybrid of *P. fruticosa* and *P. Cérusus*.

Var. *péndula*, Dipp. (*Prunus* and *Cérusus japònica péndula*, Hort.), is a most ornamental form with drooping branches, excellent for top-working on standard stocks (Fig. 3236). G.W. 10, p. 511. This is

sometimes confounded with *P. semperflorens* (No. 53), but is distinguished at once by its foliage, its early blooming, its fls. in clusters, and its dwarf habit. This is the form of *P. fruticosa* chiefly known in this country. A similar pendulous form, but with larger and more crenate-serrate lvs., is known as *P. reflèxa*, Hort.; perhaps a hybrid of *P. fruticosa* and *P. semperflorens*. Var. *variegàta*, Hort., has lvs. marked with yellowish white.

53. *Cérusus*, Linn. (*Cérusus vulgàris*, Mill. *C. caproniàna*, DC. *P. austèra*, Ehrh.). SOUR, PIE, or MORELLO CHERRY. Figs. 907, 910, Vol. II. Rather low round-headed tree with gray bark and no central leader (compare Figs. 907 and 906, Vol. II), suckerling from the root: lvs. ovate-obovate or short-ovate, abruptly short-pointed, stiff and parchment-like and



3236. Weeping dwarf cherry stock. One of the best of the and known under several *fruticosa* var. *pendula*. (No. 52.)

of Europe, grafted on Morello small ornamental species, names in nurseries. —*Prunus*

more or less glossy above, light or gray-green: fls. in small clusters from lateral buds mostly in advance of the lvs., the scales of the fl.-buds small; calyx-tube glabrous, little if any constricted at top, the lobes deflexed and crenate, obtuse: fr. roundish or depressed-globular, red, soft-fleshed, acid; stone globular. Native to Asia



3237. *Prunus Cerasus* var. *sempervlorens* ($\times \frac{1}{2}$). No. 53.

Minor and perhaps to S. E. Eu.—*P. Cerasus* is the common pie cherry of old yards. It escapes into fence-rows and other waste places, forming dense thickets, as does the plum. It sprouts from the root. The various Morellos belong here; also the Montmorency, Louis Phillippe, and others. There are at least 2 well-marked groups of these pomological cherries—those with uncolored juice (Amarells, the *Prunus acida* of some), and those with colored juice (Morellos or Griottes). To the former group belong the Montmorency, Early Richmond, and several early varieties. Many botanical Latin names have been applied in this group of cherries, and the interpretation of the relative systematic standing of the different forms is much confused. For our purpose, the leading forms may be ranged as follows: Var. *frutescens*, Schneid. (*P. acida*, Koch), comprising the bushy small-fruited spontaneous or run-wild forms. Var. *typica*, Schneid., comprising the tree-like cult. forms of many kinds. To this latter group or class belong not only the orchard sour cherries, but also such ornamental varieties or groups as follow. Var. *Rhéxii*, Kirchn. (var. *ranunculiflora*, Hort.). Fls. double, white. F.S. 17:1805. Gn. 78, p. 228. Var. *persiciflora*, Koch. Fls. full, double, light rose or pink. Var. *variegata*, Hort. Lvs. variegated with yellow and dull white. Var. *aucubæfolia*, Dipp. Lvs. spotted with yellow. Var. *cucullata*, Kirchn. Lvs. puckered or blistered. Var. *globosa*, Spaeth. Low round-headed small-lvd. bush.

By some authors, the species is divided into the *Eucerasus* (i.e. true *Cerasus*) group, comprising the tree-form kinds, with strong branches erect or ascending or perhaps somewhat drooping with age, lvs. and

petioles with or without glands, large or good-sized fr. with globular or only rarely ovoid stone; and the *Acida* group (*P. acida*, Koch, not Ehrh.), comprising the more bush-like forms (as the *Ostheim*), with more drooping or hanging branches, short gland-bearing petioles, and smaller globular fr. with ovoid stone about $\frac{1}{2}$ in. or less long. To this latter race probably belong several forms more or less cult. for ornament, as *P. acida* var. *dumosa*, Hort., a bushy form blooming profusely when young. Gn. 78, p. 201.

Var. *sempervlorens*, Loud. (*P. semperflorens*, Ehrh. *Cerasus semperflorens*, DC.). EVERBLOOMING CHERRY. ALL-SAINTS' CHERRY. Figs. 3237, 3238. A horticultural state of *P. Cerasus* var. *typica*: small tree or a bush, usually top-worked on other stock, with a straggling or drooping habit, the slender twigs glabrous: lvs. oval to oblong-obovate, short-pointed (or acuminate on the strong shoots), irregularly dentate, rather hard and firm in texture: fls. white, on long axillary and terminal peduncles from May till September: fr. like a small pie cherry, but mostly longer-stalked and smaller, dark red.—Its habit of blooming all summer makes it a desirable ornamental subject. The lvs. resemble those of *P. Cerasus*, except that they are smaller. Known in France as *Cerisier de la Toussaint* ("All-Saints' cherry") and in Germany as *Allerheiligen Kirsche*. There is a form with yellow-variegated lvs. The Everblooming cherry appears to be very little planted in this country, but it is an interesting form.

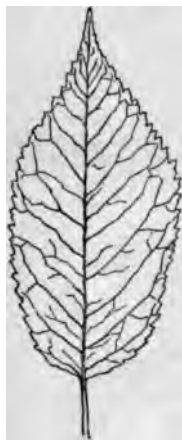
54. *avium*, Linn. (*Prunus Cerasus* var. *avium*, Linn. *Cerasus avium*, Moench. *C. nigra*, Mill. - *C. dulcis*, Gaertn.). SWEET CHERRY. MAZZARD. Figs. 3239; also Figs. 906, 908, 909, Vol. II. Tall robust tree with red-brown bark, sometimes 100 ft. high, the young trees with a strong central leader and pyramidal growth, the old seedling trees sometimes becoming 2 ft. and more in diam. (see Fig. 908, Vol. II): lvs. generally oblong-ovate and gradually taper-pointed, dull and soft in color and texture, hanging as if limp on the young growths: fls. in dense clusters on lateral spurs and appearing with the hairy strongly conduplicate young lvs., the scales of the fl.-buds large and persistent for a time; calyx-tube glabrous, constricted near the top, the lobes reflexed and entire: fr. globular, depressed-globular or heart-like, mostly sweet, yellow or red. Eu. and W. Asia.—The parent species of the many sweet cherries (and also of the May Duke class), and now run wild in many parts of the E. The run-wild and common seedling forms, with small frs., are known under the general name of Mazzard cherries.



3238. *Prunus Cerasus* var. *sempervlorens*. (Spray $\times \frac{1}{4}$)

Mazzard stocks, mostly imported, are used as stocks for cherries, although Mahaleb is more popular with propagators because (like the Myrobalan plum) it is easier and cheaper to grow, runs more uniform and is capable of being budded through a long season.

There are many ornamental forms of the *P. avium*, as: var. *pyramidalis*, Hort., tree making a pyramidal crown; var. *pendula*, Hort., with



3239. *Prunus avium* (X $\frac{1}{2}$). No. 54.

drooping branches (Gn. 59, p. 267); var. *variegata*, Hort., with yellow and dull white markings on the foliage; var. *asplenifolia*, Kirchn., with deeply toothed and cut lvs.; var. *plena*, Hort., with double fls. (G.M. 53:9. G.W. 6, p. 329. Gn. 78, p. 242); var. *salicifolia*, Dipp., with very narrow lvs. *P. Fontanesiana*, Schneid. (*Cerasus Fontanesiana*, Spach. *P. græca*, Desf.), is probably a hybrid of *P. avium* x *P. Mahaleb*, like *P. avium* in habit: young branchlets pubescent: lvs. about 4 in. long, differing from those of *P. avium* in the more crenate gland-tipped serrations: does not produce fr. To *P. avium* are to be referred such garden names as *P. angustifolia*, *P. heterophylla*, and others.

Var. *Juliana*, Bailey (*Prunus Cerasus* var. *Juliana*, Linn. *Cerasus Juliana*, DC.). HEART OF GEAN CHERRIES. Fr. heart-shaped, with soft flesh, as in the varieties Governor Wood, Black Tartarian, Black Eagle. These are the *Guigniers* and *Heaumiers* of the French. A weeping form is known as *P. Juliana* var. *pendula*.

Var. *regalis*, Bailey (*C. regalis*, Poit. & Turp.). DUKE CHERRIES. Differ from the Heart cherries in having an acid flesh (and for that reason often erroneously referred to *P. Cerasus*). May Duke is the leading representative. Said by Hedrick ("Cherries of New York") to be "unquestionably hybrids between the Sweet cherry and Sour cherry," *P. avium* and *P. Cerasus*.

Var. *duracina*, Bailey (*Prunus Cerasus* var. *duracina*, Linn. *C. duracina*, DC. *C. Bigarëlla*, Roem.). BIGARREAU or HARD-FLESHED CHERRIES. Distinguished by the firm breaking flesh of the fr., which is mostly of light color. Here belong the Windsor, Yellowish Spanish, Napoleon.

Var. *decumana*, Koch (*C. decumana*, Delann. *P. macrophylla*, Poir. *P. nicotianæfolia*, Thomps.). Lvs. very large (sometimes nearly 1 ft. long and 4-6 in. broad), somewhat heart-shaped. Grown for ornament.

BB. Sepals or calyx-lobes erect-spreading.

C. Floral involucre (at base of infl.) large, about $\frac{1}{2}$ in. long or more: lvs. not lobulate or incised-double-serrate.

D. Fruiting pedicel not thickened, or only very gradually so at apex.

E. Calyx-tube acute at base, narrowly tubular or turbinate-tubular: fr. black. This group comprises the famous Japanese flowering cherries of midspring and later.

55. *serrulata*, Lindl. (*Cerasus serrulata*, Don. *C. serratifolia*, Carr. *Prunus Pseudo-Cerasus*, Hort., not Lindl. *P. mutabilis*, Miyoshi, in part.) JAPANESE FLOWERING CHERRY. Large tree, long in cult., but, like other Japanese and Chinese cherries, little known in Amer.: lvs. large (3-6 in. long and 2 in. or more broad), oval, ovate to obovate, abruptly long-acuminate, glabrous, glaucescent beneath, deep green, the prominent teeth short-aristate; petiole glabrous, glandless or with 1 or 2 small glands near apex: fls. white, not fragrant, semi-double, in a large glabrous infl., appearing with

lvs. or just preceding them, in 3-5-fl. clusters on short or long peduncles, the bracts large, fimbriate, the pedicels to 1 in. long; calyx-tube glabrous, the ovate-acute lobes or sepals mostly exceeding the tube; style glabrous: fr. size of small pea, black. China, Japan, Korea. G.C. III. 7:609; 19:467. Gn. 56:300. A.G. 12:399.—This showy species occurs in cult. in many forms, with fls. whitish or pink and otherwise variable, often under the name of *P. Pseudo-Cerasus*. A very double pink and rather small-fl. form is forma *rosea* Wilson (f. *Shidare-Sakura*, Koehne). Var. *spontanea*, Wilson, is a wild form in China, Korea, and Japan, with single white or pink fls. about $\frac{1}{4}$ in. across, and lvs. greenish brown to reddish brown when unfolding. This form is also cult. in the Orient. It makes a tree to 75 ft. high and 12 ft. in girth. Formæ of this variety are f. *humilis*, Wilson, bush or small tree with pale fls. and rather glaucous under surface of lvs., the peduncle elongated, cult. in Japan; f. *Kosioyama*, Wilson, fls. single, pinkish, lvs. slightly hairy on upper surface of midrib, cult. in Japan and intro. in this country; f. *præcox*, Wilson, fls. single and rather small, pale pink, blooming in late winter in Japan, and also intro. in this country. Var. *pubescens*, Wilson (*P. tenuiflora*, *P. Leveilléana*, *P. mesadenia*, *P. Veluchii*, *P. verocunda*, Koehne. *P. quelpaertensis*, Nakai). Lvs. pale green below and more or less sparsely pubescent, the petiole somewhat bearded, and pedicels pubescent: fls. single, white or pink. China, Korea, Japan; said by Wilson to have the widest distribution of any Japanese cherry, and it is there cult., and forms of it have been intro. in this country. Wilson recognizes the following formæ of this variety: *sancta* (Meigetsu), lvs. slightly villous above and pale beneath, the fls. single, white changing to pale pink; *Shibayama*, fls. single and pink, of little horticultural value; *Taisanfukun*, first described under this species, is now referred by Wilson to *P. yedoensis*.

Var. *sachalinensis*, Makino (*P. Pseudo-Cerasus* var. *sachalinensis*, F. Schmidt. *P. sachalinensis*, Koids. *P. Sargentii*, Rehd. *P. floribunda*, Koehne). Fig. 3240. Large tree attaining a height, in its native places, of 60-80 ft. with trunk 9-13 ft. in girth and head 30-50



3240. *Prunus serrulata* var. *sachalinensis* (X $\frac{1}{4}$). No. 55.

ft. across, producing valuable wood: bark reddish and lustrous; older branches chestnut-brown. lvs. large, oval or ovate, abruptly slenderly acuminate, coarsely sharp-toothed, glabrous and lustrous, turning to crimson and yellow in autumn, mostly with glands on petiole or base of blade: fls. 2-4, very showy, rose-pink, appearing before the lvs., simple (not double), light rose-color, about $1\frac{1}{2}$ in. across, the pedicels slender, to $1\frac{1}{2}$ in. long and with glandular serrate bracts or involucre; petals obovate and emarginate; calyx-lobes ovate-lanceolate, acute, entire; stamens 20-25: fr. size of pea, bright red and becoming black and shining at maturity. June. N. Japan, Saghalin, Korea. B.M. 8411. G.C. III. 19:517; 55:346. G.F. 10:463 (shown reduced in Fig. 3240).—A tree of great ornamental value, hardy in N. Y. and Mass., bearing profusely of its handsome broad fls. From *P. serrulata* it is distinguished by its broader more coarsely serrate lvs., of which the serratures are scarcely pointed: lvs. glabrous, bronze-metallic green when unfolding, becoming yellow, orange, and crimson in autumn; serration simple and double on same lf., the teeth gland-tipped and mucronate or aristate: fls. appearing with the lvs. or slightly in advance, $\frac{1}{2}$ - $1\frac{1}{4}$ in. across, rose, pink, or nearly white. The forms of var. *sachalinensis* comprise some of the hardest and best of the flowering cherries of Cent. and N. Japan. Of this important and very worthy variety, the following formæ are recognized by Wilson, most of which have been intro. into N. Amer. recently and all of which are named flowering cherries of Japan: *Benden*, pale pink single, or nearly single fls., of small horticultural value; *Hakkasan*, fls. pale pink, single or nearly so, of little value; *albo-rosea* (*P. Pseudo-Cerasus*, var. *Shirofugen*, Spaeth), fls. pink in bud and changing to white as they expand, bearing 2 leafy green carpels in the center, handsome; *Fugenzo* (*P. Pseudo-Cerasus*, G.C. III. 19:517. *P. Pseudo-Cerasus* var. *James Veitch*, Gt. 51:497. *P. serrulata* f. *Veitchiana*, Koehne), one of the handsomest and known in cult. as James H. Veitch, with rose-pink fls. bearing 2 leafy carpels in center; *Hsakura*, fls. pale pink, double, one of the handsomest; *Horinji* (*Cerasus Juliána flore roseo pleno*, Carr. R.H. 1874, p. 20. *C. Caproniana flore roseo pleno*, Van Houtte. F.S. 21:2238), fls. in clusters, pale pink and semi-double; *fasciculata* (*Itokukuri*), fls. double pink, clustered at ends of shoots; *Kirin*, late-flowering, with large very double rose-colored fls., one of the best; *homogena* (*Kokonaye*), fls. pink, long-pedicelled and usually short-pedicelled, double or semi-double, pink; *Masuyama*, a fine form with double rose-pink fls.; *Ohnanden*, a fine form with rose-pink double or semi-double fls.; *Sekiyama*, late, with large double rich rose-colored fls., thought by Wilson to be "the handsomest of all Japanese double-fl. cherries;" *superba* (*Shogetsu*), rather late, good, very large, double, pale pink, long-pedicelled; *Shujaku*, fls. borne in great profusion, double, rose-pink; *spiralis* (*Udzuzakura*), a good form producing pink double fls. freely near ends of branches, with short peduncle and long pedicels.

Prunus Pseudo-Cerasus, Lindl. (*P. involucrata*, Koehne), with which *P. serrulata* and other Japanese flowering cherries have been confused, is an entirely different species. It is not hardy in the northern states, and apparently is not in cult. in this country except perhaps under test in Calif. or elsewhere. It belongs to another subsection of the genus, more nearly allied to *P. canescens* and *P. lobulata*, described under Nos. 65 and 66. It is grown in China and also in Japan for its edible red subglobose apiculate fr., which is about $\frac{1}{2}$ in. or less in diam.: small tree, to 25 ft., the shoots pale gray to purplish and sparsely pubescent when young: lvs. sparsely pubescent but glabrous above at maturity, ovate to broad-ovate, secondary veins few, acuminate, rounded at base, doubly serrate with broadly triangular teeth: calyx-tube or cupula broadly obconic and

pubescent: fls. white, 2-5 in a cluster, 1 in. across; style glabrous. Wilson states that "as a fruit tree it does not compare in value with the European varieties derived from *P. Cerasus* and *P. Avium*."

56. *Lannesiana*, Wilson (*Cerasus Lannesiana*, Carr. *P. serrulata Lannesiana*, Koehne. *P. Pseudo-Cerasus* var. *hortensis*, Maxim. in part). Fig. 3241. Differs from *P. serrulata* in its pink fragrant fls. (white in some of the formæ), teeth of lvs. long-aristate (rather than short-aristate), bark pale gray rather than dark chestnut-brown: lvs. unfolding green or slightly reddish, pale green beneath: calyx-tube or cupula campanulate, glabrous. Japan. B.M. 8012 and G.C. III. 19:466 (both as *P. Pseudo-Cerasus*). R.H. 1872, p. 198 (note); 1873:351. Forma *albida*, Wilson (*P. serrulata* f. *albida* and *speciosa*, Koehne *P. mutabilis*, Miyoshi, in part), has single white fls. This form is considered by Wilson to be the parent of the cult. kind taken as the type of *P. Lannesiana* and "also of the greater number of the double-fl. Japanese cherries;" thought to be indigenous on island of Oshima. It makes a tree to 30 ft. or more tall, with thick spreading or somewhat ascending branches, with a pale gray bark which is smooth even on old trees: fls. pinkish in the bud, white when open, glabrous



3241. Japanese flowering cherry.—*Prunus Lannesiana* (× $\frac{1}{2}$). No. 56.

throughout, either with the lvs. or preceding them, the peduncle usually $\frac{1}{2}$ -1 in. long but sometimes wanting: fr. ovoid, black, and shining.

Some of the cult. kinds of *P. Lannesiana* in Japan, many of which have recently been intro. into this country, are ranged by Wilson under the following formæ: *donarium* (*P. donarium*, Sieb.), fls. white and double, fragrant; *Fudanzakura*, a precocious form that blooms at almost any season, the single fls. white or nearly so, of little horticultural value; *Gozanomanioi*, fls. white, single, very fragrant; *Habutai*, fls. single, white, and fragrant, of minor value; *Minakami*, fls. very fragrant, white, single or nearly so; *Ohshibayama*, of minor value, the fls. white flushed pink, single or semi-double; *subfusca* (*Sumizome*), one of the handsomest; with very large fragrant single or nearly single white fls. flushed pink; *ataracta* (*Takinioi*), fls. very fragrant, single, white; *Wasinowo*, fls. single, fragrant, white; *Amayadori*, excellent, botanically much like *P. serrulata* var. *sachalinensis*, with double fls. clustered at ends of branchlets, pale pink passing to white; *Hatazakura*, fls. semi-double, white tinged pink, the inner petals reduced and rudimentary, said by Wilson to be "a very beautiful cherry, with fls. suggestive of apple

blossoms;" *Horaisan*, fls. white, semi-double; *Hosokawa*, "a pleasing form" with fls. single or semi-double, pure white, and fragrant; *affinis* (*Joniot*), "A lovely plant with fls. of remarkable whiteness," very fragrant, single or semi-double; *Kokesimidsu*, of minor horticultural interest, the fls. single or semi-double, white suffused pale pink; *Kunrinjishirotae*, fls. white, fragrant, semi-double; *Miyako*, one of the best of the late-flowering forms, with fragrant double fls. white flushed pink; *Senriko*, beautiful form, with very large fragrant semi-double fls. pale pink passing to white; *Sirotae*, "the finest of all the double-fl'd. white cherries," the fls. large and fragrant and pure white; *Sobanzakura*, fls. double, white; *Surugadai-odora*, late-flowering, the fls. nearly white, semi-double, fragrant, pendulous on long slender pedicels; *Ariake*, "a very striking form," with very large and fragrant single or semi-double pale pink fls.; *exelsa* (*Barriko*), of minor horticultural value, with single fls. "pale washy pink;" *campanulata* (*Gijozakura*), pink, single or semi-double; *Kirigaya*, fls. fragrant, single, pale pink; *Kongosan*, of minor interest, with single pink fls.; *Mazakura*, "the cherry used by the Japanese for a stock on which to graft all the garden forms of *P. Lannesiana* and *P. serrulata*," with few white or pinkish fls.; *Ranzan*, "a very pleasing form," with single pink fls. on long slender pedicels; *Temari*, fls. congested near end of branchlets, pale pink, single and semi-double; *erecta* (*Amanogawa*), "a beautiful form and very distinct in its habit of growth," branches fastigate, the fls. fragrant, semi-double, pale pink; *Benitoranowo*, "a good form," with rose-pink semi-double fls. clustered near ends of branchlets; *Moutan* (*Botanzakura*), "one of the very best forms," bearing very large, pale pink, fragrant, semi-double fls.; *Gosiozakura*, fls. semi-double, pale pink; *amabilis* (*Higurashi*), "a good form," with slightly fragrant, double and semi-double, pale pink fls.; *Isezakura*, semi-double, fragrant, pink; *Mikurumakaisi*, double, pale rose; *Ochichima*, fls. large, double, pale pink; *Ogon*, "a very beautiful form, commonly cult. in the temple grounds at Kyoto," with fls. pale pink and semi-double; *Ojochin*, "one of the best forms," the very large fls. semi-double and pale pink; *vericolor* (*Yayakebono*), fls. very large, fragrant, semi-double, soft pink, very beautiful; *nobilis* (*Yedozakura*), resembles *P. serrulata* var. *sachalinensis*, "a fine cherry," with pink double clustered fls. of good size; *Gioiko*, semi-double fls., pale yellow with greenish stripes, free-flowering; *grandiflora*, "a very striking cherry," with profusion of large semi-double or double greenish yellow fls. (Gn. 76, p. 229, as *P. serrulata* flore luteo pleno. Gt. 52:1513 as *P. serrulata* grandiflora).

57. *Sieboldii*, Wittm. (*Cerasus Sieboldii*, Carr. *P. Pseudo-Cerasus* var. *Sieboldii*, Maxim. *Cerasus Watereri*, Hort.). JAPANESE FLOWERING CHERRY. Strong-growing tree, like a sweet cherry, producing showy pink double fls. with the lvs. or just in advance of them: lvs. oval or ovate, abruptly acuminate, rounded at base, densely soft-pilose beneath, the margins very sharply gland-serrate; petiole hairy, usually bearing 1 or 2 small glands at apex: fls. 1-1½ in. across, 2-4 on each short peduncle, the pedicels more or less pilose; calyx-tube sparsely hairy or nearly glabrous, the ovate rather obtuse entire lobes about equaling the tube; style hairy at base. Japan, China. Known only in double-fl'd. forms. R.H. 1866, p. 371. Gn. 33, p. 420. G.W. 16, p. 355. Gt. 51:1494a. A.G. 12:400, 401.—Wilson writes that in habit and general appearance this species strongly resembles *P. Lannesiana*, but is distinguished by the pubescent caudate-acuminate lvs. which are sharply and often obscurely doubly serrate with small teeth: fls. double or semi-double, normally pink and preceding the foliage; if the fls. precede the lvs. the peduncle is very short, when coetaneous with the foliage the peduncle is much elongated and the fls. may then be nearly or quite white.

58. *yedoensis*, Mats. (*P. paracerasus*, Koehne. *P. yedoensis* var. *nudiflora*, Koehne). Near *P. serrulata*, differing in the pedicels, style, and usually exterior of calyx being hairy; and near *P. Sieboldii*, differing in young lvs. pale green rather than bronzy, and calyx-lobes sharp-serrate rather than entire. From Japan, but wild specimens unknown.—A tree-like shrub or good-sized tree, with young growth hairy but becoming nearly or quite glabrous in autumn or the second year: lvs. obovate or broadly ovate-elliptic, 3-5 in. long, acuminate, strongly double-serrate with serratures acuminate and gland-tipped, glabrous above, hairy on midrib and veins beneath: fls. in a 3-6-fl'd. short-peduncled corymb or cluster, with narrowly spatulate bracts, the pedicels ½-1½ in. long and densely pilose; petals broad-ovate or suborbicular, about ½ in. long or a little more, deeply emarginate; stamens about 37-39. The fls. are slightly fragrant, in clusters of 2 to several, usually preceding the lvs. but sometimes coetaneous, white to pink. "This is the cherry," writes Wilson, "so generally planted in the parks, temple grounds, cemeteries, and streets of Tokyo. Its flowering is the occasion of a popular festival in the city of Tokyo. The oldest authentically known trees were planted only a little over 40 years ago, and the species was not recognized as distinct till 1901. To Wilson the species is strongly suggestive of a hybrid between *P. subhirtella* var. *ascendens* and the wild form of *P. Lannesiana*. It is hardy at the Arnold Arboretum. *Taizanfukun* (*P. fruticosa* f. *ambigua*, Miyoshi) is a form with young shoots and petioles pubescent, fls. borne near ends of shoots, moderately double and of medium size, pink.

EE. Calyx-tube obtuse at base, campanulate or cylindrical: fr. red to black.

F. Blossoms appearing before the lvs.: teeth of lvs. large, acute, acuminate, or setaceous-acuminate: stone nearly or quite smooth.

59. *Conradinae*, Koehne. Graceful tree, to 25 ft., with rather thin glabrous or canescent shoots and large foliage: lvs. obovate or obovate-oblong, rarely roundish ovate, 2-6 in. long and about half as wide, the base usually rounded or even subcordate, apex narrow-acuminate, double-serrate, the teeth gland-tipped, glabrous or becoming so above and below; petiole about ½ in. long, glabrous, mostly with 2 glands; stipules linear, glandular-fimbriate: fls. whitish or pink, before the lvs.; peduncle sometimes ½ in. long but usually very short; pedicels (mostly 2-4 in the umbel) ¼-½ in. long, glabrous; calyx-tube glabrous; lobes or sepals erect-spreading or spreading, more or less ovate, entire; petals about ½ in. long and ½ in. broad, emarginate-bilobed; style glabrous: fr. ovoid, ⅓-½ in. long, red. Cent. China.

FF. Blossoms appearing with the lvs.: teeth of lvs. small or minute: stone prominently rugose.

60. *serrula*, Franch. Tall tree, with young branches thinly pubescent but becoming nearly or quite glabrous in autumn: lvs. lanceolate, 2-4 in. long, base rounded, apex acuminate, strongly but shortly double-serrate, the teeth slender and gland-tipped, soon glabrous above, hairy along rib and in nerve-axils beneath, at base usually with 3-5 glands; petiole ⅓-½ in. long, glabrous, purplish. Apparently known to cult. in the var. *tibetica*, Koehne, which has smaller teeth on the lvs.: fls. white, usually in 3's: fr. ovoid or globular-ovoid, about ½ in. long, red. W. China.—Cult. abroad; hardy in Mass.

DD. Fruiting pedicel prominently thickened.

61. *cerasoides*, D. Don (*P. Puddum*, Roxbg. *Cerasus Puddum*, Wall. *C. Phoshia*, Hamilt.). A Himalayan representative of *P. Pseudo-Cerasus*, described by Hooker as a large tree of brilliant appearance in flower, glabrous except the puberulous young shoots, the rose-red or

white fls. solitary, fascicled, or umbelled, the calyx-tube narrowly campanulate and the petals obovate or linear-oblong: lvs. ovate-lanceolate or oblong-lanceolate, caudate-acuminate, sharply serrate, glabrous, 3-5 in. long, the petiole with 2-4 glands: fr. oblong or ellipsoid, obtuse at both ends, with scanty yellow or reddish acid flesh; stone bony and furrowed. Temp. Himalaya, 3,000-8,000 ft.—The name is catalogued in S. Calif., with the statement that the tree "blossoms in November and ripens its fruit in April." Hooker (Fl. Brit. India) places it with species having "flowers appearing before the leaves."

62. *campanulata*, Maxim. (*P. cerasoides* var. *campanulata*, Koidz.). Closely related to *P. cerasoides*: tree, to 25 ft.: lvs. ovate to elliptic-ovate, glabrous, usually doubly serrate, 3-5 in. long: fls. pendulous, campanulate, $\frac{3}{4}$ in. long, deep rose-colored; calyx purple: fr. ovoid, $\frac{3}{8}$ in. long, red. Formosa, probably Liu-kiu Isls., cult. in S. Japan. Gn. 56:300 (as *P. pendula*).—Very ornamental; not hardy N. A beautiful species as grown in Japan. The Himalayan species (*P. cerasoides*) has more coriaceous and more sharply toothed lvs. in which double serration is usually not so marked.

63. *rufa*, Steud. Small tree, to 20 ft., the young growth densely tomentose: lvs. elliptic-lanceolate or oblong-lanceolate, 1-4 in. long, narrowed to very short petiole, long-acuminate, glabrous or puberulent on rib or nerves above and beneath, very sharply glandular-serrate; petiole pubescent, glandless; stipules thread-like and lacinate: fls. pink, $\frac{1}{2}$ in. diam., solitary, paired or fascicled in the axils of previous year's growth, appearing with the lvs., the stalks longer than petiole; calyx-tube urn-shaped, glabrous, the lobes triangular and dentate; petals small and orbicular: fr. ellipsoidal, on lengthened stalks, fleshy, red. Nepal and Sikkim, 12,000 ft. altitude.—Recently cult. in England.

cc. *Floral involucre either small or the lvs. prominently lobulate or incised-double-serrate.*

d. *Lvs. shortly or rather deeply serrate: involucre small, $\frac{1}{5}$ to about $\frac{1}{2}$ in. long: fls. with the lvs. or preceding them, the umbels sessile or the peduncles $\frac{3}{8}$ in. or less long: fr. mostly black. The early spring-flowering cherries of Japan.*

64. *subhirtella*, Miq. (*P. Miqueliana*, Maxim. *P. Herincquiana* var. *ascendens*, Schneid.). Plant a large shrub or small forking tree, with erect branches: lvs. shorter and relatively broader than in var. *pendula* (blade about 2 in. long except on terminal shoots), oval or ovate, abruptly narrowed above and below, sharply and more or less doubly serrate, more hairy beneath and sometimes thinly short-hairy above, the glands small or wanting: fls. 1 in. across. Much cult. in Japan, but unknown wild; less known in this country than var. *pendula*, but perhaps more beautiful. B.M. 7508. G.C. III. 33:163; 53:285. Gn. 63, p. 177. G. 25:147; 31:283.—This is the spring cherry of Japan and said by Wilson to be "the most floriferous and perhaps the most delightful of all Japanese cherries." Appears to have been intro. into N. Amer. first in 1894 by the Arnold Arboretum. The fls. normally appear in advance of the lvs., varying in color from nearly white to pink; calyx reddish. Sometimes a few fls. appear in autumn. Wilson writes that in its typical form this species may be separated from its varieties in herbarium material by its usually smaller and more glabrous lvs. and by its very numerous fls. which have less hairy and more highly colored calyx-tube and sepals. In living trees, the species is marked by its small size and ascending branches.

Var. *pendula*, Tanaka (*Cerasus pendula*, Sieb. *C. itosakura*, Sieb. *Prunus itosakura*, Sieb. *P. pendula*, Maxim. *C. japonica* and var. *rosea*, Hort.). ROSE-BUD CHERRY. JAPANESE WEEPING ROSE-FLOWERED

CHERRY. Fig. 3242. Small tree, with drooping crooked branches: lvs. lance-elliptic to oblong-oval or oval on older shoots (blade 3-4 in. long), acuminate, mostly narrowed at base, sharp-serrate, usually with a pair of large glands at base of blade or on apex of petiole, glabrous above, thinly hairy on rib and veins underneath: fls. $\frac{3}{4}$ in. across, on long minutely pubescent stalks, in small clusters, from lateral buds before the lvs. appear, rose-pink, the petals notched at the tip, the calyx-tube funnel-form and red; style hairy: fr. very small, globular, black-red, somewhat astringent. Japan. B.M. 8034. R.H. 1876, p. 328. Gn. 50:454. F.M. 1871:536. G. 30:177. G.F. 1:198.; 2:487 (old tree). Gng. 2:269. M.D.G. 1890:320, 321.—One of the handsomest of early-flowering trees, producing its chaste pink fls. in profusion. Hardy in Cent. N. Y. Seedlings sometimes have more erect and spreading



3242. *Prunus subhirtella* var. *pendula*, the rose-bud cherry ($\times \frac{1}{2}$). No. 64.

branches. Should be grown from seeds or worked on the upright forms of the species, according to Wilson, for it does not thrive on the European cherry stocks.

Var. *ascendens*, Wilson (*P. pendula* var. *ascendens*, Makino. *P. itosakura* var. *ascendens*, Koidz. *P. Herincquiana*, Koehne. *P. microlepis*, Koehne). Regarded by Wilson as the prototype of *P. subhirtella* and var. *pendula*. A tall strong tree with massive wide-spreading branches but the branchlets rather sparse and causing the head to have a thin appearance: lvs. somewhat larger than in *P. subhirtella* itself. Differs only in habit from var. *pendula*, and the two cannot be distinguished on the herbarium sheet. It is cult. in Japan, but is yet unknown as a horticultural plant in N. Amer. and Eu., although recently intro. Indigenous in Cent. China and probably also in Korea and Japan.

Var. *autumnalis*, Makino (*P. subhirtella* var. *Fukubana*, Makino. *P. autumnalis*, Koehne. *P. Makinodana*, Koehne. *P. microlepis* var. *Smithii*, Koehne. *P. Cerasus Chedii pendula*, Hort.). An abnormal form, semi-double, blooming in April and again in Oct.; bush-like in stature, with slender wide-spreading branches. G.C. III. 52:432; 58:244. Gn. 76, p. 628 (all as *P. Miqueliana*).—"The flowers in

autumn are smaller than those of spring, and in each case when the flowers are produced before the leaves or after the leaves have fallen the peduncle does not elongate and the plants present no striking differences. But on some individuals in the spring the leaves and flowers unfold at the same time and the peduncle is then much elongated. Such specimens look utterly dissimilar, yet whether the flowers open before or at the same time as the leaves is not fixed and may vary on the same individual from year to year."—Wilson.

DD. *Lvs. prominently incised- or lobulate-double-serrate or -crenate: fls. usually appearing with the lvs.*

65. *canescens*, Bois. Attractive shrub, 5-7 ft.: lvs. lanceolate, 2-2½ in. long, short-hairy on both surfaces, deeply bidentate, the teeth broader than long, cuspidate or mucronate, gland-tipped: fls. 2-5 together, rarely single, on the young shoots, white tinted rose; calyx-tube about ¼ in. long; calyx-lobes or sepals shorter than the tube, serrulate or rarely entire, glabrous or nearly so on the inside; petals nearly ¼ in. long, oblong: fr. small, red. Cent. and W. China.

66. *lobulata*, Koehne. Tree, to 35 ft. or so, lately cult. abroad: lvs. oblong, obovate, or oblong-lanceolate, 1-3 in. long, somewhat acuminate, doubly serrate with the teeth strongly acuminate and either glandless or the gland a minute terminal point, glabrous or nearly so except perhaps sparsely hairy on nerves, with 1 or 2 glands at base of blade or at apex of petiole, apex of blade obtuse or obscurely emarginate: fls. white: fr. globose or nearly so, about 1 in. long, red. W. China.—Hardy in Mass.

67. *incisa*, Thunb. (*Cerasus incisa*, Loisel.). Allied to *P. lobulata*. Shrub, to 15 ft., or sometimes tree, to 30 ft.: lvs. ovate to obovate, acuminate, incisely doubly serrate, pubescent above and on the veins beneath or nearly glabrous, ¾-2½ in. long: fls. 1-3, nodding, with leafy bracts at base; calyx vinous-red; petals white or pink, rather fugaceous: fr. ovoid, purplish black, ¼ in. long. Japan. S.I.F. 1:28.—Cult. in Japan, making a very ornamental bush, but apparently unknown to planters in N. Amer.; it is now growing at the Arnold Arboretum.

68. *nippónica*, Matsum. (*P. iwagiensis* and *P. nikkoensis*, Koehne). Allied to *P. incisa*. Bushy tree, to 20 ft.: older branches chestnut-brown: lvs. ovate, long-acuminate, usually rounded at base, incisely doubly serrate, pubescent while young, finally nearly glabrous; petioles glabrous: fls. 1-3, slender-stalked, white or pale pink, 1 in. across: fr. globose, ½ in. across, black. Japan, at high altitudes, probably adaptable to cold locations in this country. Var. *kurilensis*, Wilson (*P. kurilensis*, Miyabe). Petioles pubescent: fls. somewhat larger; pedicels and calyx pubescent. Japan, Kurile Is.

69. *apétala*, Franch. & Sav. (*Cerasoides apétala*, Sieb. & Zucc. *P. crassipes*, Koidz. *P. Tschonésckii*, Koehne). Shrub or tree, with young branches glabrous: lvs. oblong or obovate-oblong, 1-2 in. long, caudate at apex, doubly serrate and as if somewhat lobed, the teeth narrow and tipped by gland, close-villous above and villous beneath, especially on the nerves; petiole short, densely villous, usually with 1 or 2 glands: fls. with deep purple calyx and sepals and very small fugaceous petals, 1-2 together, appearing with the lvs., the pedicels nearly 1 in. long and hairy; sepals or calyx-lobes ovate, about ½ in. long, very slightly hairy outside; stamens 26, shorter than the style. Japan.—The *P. apétala* mentioned in horticultural literature may be a form of *P. Maximowiczii*; but the present description is of the true species. Var. *pilosa*, Wilson, has much larger fls. and the branches are less hairy, and rather more floriferous than the type; superior horticulturally. *P. apétala* is little known in cult. in this country.

Subgenus IV. PADUS (including *Laurocerasus*). Racemed Cherries.

Fr. small and globular, rarely used for eating: fls. white, small, in distinct racemes, not preceding the lvs. or else arising from the axils of persistent lvs. of the year before.

A. *Padus proper: lvs. deciduous: fls. on leafy shoots of the season (exception in No. 71).*

B. *Calyx-lobes persistent at the base of the fr.: fls. appearing relatively late in the season: large trees.*

70. *serótina*, Ehrh. (*Padus serótina*, Agardh. *Cerasus serótina*, Loisel.). WILD BLACK CHERRY. Strong straight tree, reaching 100 ft., with very dark brown bitter aromatic bark: lvs. oblong, lance-oblong or oblong-ovate, tapering to a point, thickish and firm, shining above, with many small incurved callous teeth: fls. in long, loose racemes, appearing when the lvs. are nearly full grown: fr. size of a pea, purple-black, bitterish, ripening in late summer and Sept. Generally distributed from Nova Scotia to Dakota, south to Fla. and Texas. S.S. 4:159. F.E. 32:533.—A valuable timber tree, furnishing lumber for cabinet work and house finishings; also a fine lawn tree. It is much used in forestry plantings. Var. *pendula*, Dipp., has drooping branches. G.Z. 26:241. Var. *pyramidalis*, Zabel, is of narrow pyramidal growth. Var. *variegata*, Hort., has yellow-marked lvs. Var. *cartilaginea*, Dipp. (var. *carthagena*, Hort., by error. *P. cartilaginea*, Lehm.), is a handsome form with very long, shining lvs. Var. *asplenifolia*, Hort. (*Cerasus serótina* var. *asplenifolia*, Kirchn.), has narrow deeply toothed lvs. For a note on the nomenclature of *P. serótina*, see No. 72.

Var. *neomontana*, Sudw. (*Padus serótina* var. *neomontana*, Small), of the high mountains in the southern Alleghanies, has ample leathery coarsely serrate lvs. which are pale or whitish beneath, stout few-flid. diverging racemes, and sepals and filaments pubescent.

The *P. serótina* group is now held to include other species in the southern states and southward, but apparently they are not in cult. outside botanic gardens: *P. eximia*, Small (*Padus eximia*, Small), differs from *P. serótina* in having sepals or calyx-lobes deltoid and slightly broader than long rather than ovate, and lvs. delicately reticulated rather than plain. River-valleys, Texas. *P. Cuthbertii*, Small (*Padus Cuthbertii*, Small), differs from *P. serótina* in having young parts (young shoots, raceme-axis and pedicels) pubescent rather than glabrous: lvs. obovate and blunt, finely and rather sparingly pubescent beneath and becoming glabrate and glaucous with age; drupe red. Woods, Ga. *P. alabamensis*, Mohr (*Padus alabamensis*, Small), is distinguished from *P. Cuthbertii* in having lvs. ovate, oblong, or elliptic and acute or acuminate, and drupe purple. Mountains, Ga., Ala. *P. australis*, Beadle (*Padus australis*, Small), has young parts pubescent: lvs. not glaucous but densely and permanently clothed with colored tomentum. Ala. *P. Capólin*, Koehne (*P. Capuli*, Cav. *Cerasus Capólin*, DC.), from Mex., a very large tree with long and slender pedicels: lvs. lanceolate, long-acuminate: fr. large. *P. salicifolia*, HBK., in S. Amer. and probably not in Mex. as reported: evergreen, differing little from *P. Capuli* and presumably in need of closer definition: apparently not in cult., although the name occurs in horticultural literature.

BB. *Calyx-lobes or sepals not persistent on the fr.: fls. early: small trees.*

C. *Peduncle nude (not bearing lvs.).*

71. *Maackii*, Rupr. (*Laurocerasus Maackii*, Schneid.). Tree, to 50 ft., with shoots finely pubescent or becoming glabrate: lvs. oblong to oblong-ovate or elliptic, acuminate and pointed (2-4 in. long), finely and very sharply glandular-serrate, glabrous, gland-dotted

beneath, with 1 or 2 large glands near base of blade or at apex of the petiole (which is $\frac{3}{8}$ – $\frac{1}{2}$ in. long): fls. appearing on the ends of leafless shoots, white, long-stalked, less than $\frac{1}{2}$ in. across, the racemes 2–3 in. long and dense (1– $1\frac{1}{2}$ in. long). Amurland, Manchuria.

cc. *Peduncle bearing lvs.*

72. *virginiana*, Linn. (*Cerasus virginiana*, Loisel. *Prunus nana*, Du Roi. *Pádus nana*, Roem.). CHOKY CHERRY. Fig. 3243. Bush or sometimes a small tree 30 ft. tall, with rough speckled bark and a strong odor when bruised: lvs. thin, oval-oblong or obovate, abruptly pointed, very sharply serrate, with spreading or at least not incurved teeth: fls. in short, dense racemes in spring with the lvs.: fr. size of pea, in summer, red or amber-colored (the latter var. *leucocarpa*, Wats.), puckery; stone smooth. Generally distributed over N. N. Amer. to the Arctic Circle and occurring in the mountains of Mex. S.S. 4:158.—Now and then a large-fruited variety is found fit for eating. Sometimes planted for ornament. There is a weeping form, var.



péndula, Hort.; a dwarf form, var. *nana*, Hort.; a narrow-ldv. form, var. *salicifolia*, Hort. Other more or less distinct forms may be distinguished. Recently the name *P. nana*, Du Roi, has been used for this species, and *P. virginiana* has been made to supplant the name *P. serotina* (No. 70). Linnaeus had two plants under *P. virginiana* in *Species Plantarum*. The synonyms cited by him clearly designate *P. serotina* (the black cherry), except one, which is an *Itea*; but his original description, to which he gave the name *P. virginiana* and which is based on material preserved in his herbarium, is of the chokecherry; and there seems to be no occasion to change the names of these well-known plants.

73. *demissa*, Walp. (*P. virginiana* var. *demissa*, Torr. *Cerasus demissa*, Nutt.). Lvs. more rounded than in *P. virginiana* or even subcordate, thicker, pubescent, serrate with straight teeth, the petioles glandular: fr. red, large, and edible. Wash., Ore., Calif., and probably eastward.—Considered by many to be worthy of improvement as a fruit-plant.

Var. *melanocarpa*, Nels. (*P. melanocarpa*, Shafer), has smooth lvs. and fr. nearly black when mature and more astringent: shrub or small tree: lvs. smooth or nearly so on both surfaces, the small serratures incurved or appressed, the petioles glandless: fls. white, in erect or ascending compact racemes. Rocky Mt. region and probably westward.

74. *Pádus*, Linn. (*P. racemosa*, Lam. *Pádus racemosa*, Schneid. *Pádus vulgaris*, Borkh. *Cerasus Pádus*, DC.). EUROPEAN BIRD CHERRY. Very like *P. virginiana*, but has larger fls. on longer pedicels, in longer and looser often drooping somewhat leafy racemes: lvs. elliptic to oblong-ovate to oval, broad at base, abruptly acuminate, very sharply serrate, glabrous, the petiole gland-bearing at apex: fls. appearing

a week later; petals $\frac{1}{4}$ – $\frac{1}{2}$ in. long and twice exceeding the stamens: stone rough. Eu. and Asia. Gn. 53, p. 92. G.M. 44:209. G. 20:601; 27:269.—Common in cult. in many forms: Var. *péndula*, Dipp., drooping; var. *variegata*, Hort., in several forms, as *aurea*, *aucubifolia*, *marmorata*, *Alberti*. Var. *leucocarpa*, Koch, has white or yellowish lvs. Var. *bracteosa*, Ser., has very large lvs. at the base of the racemes. Var. *commutata*, Dipp. (*P. Grayana*, Hort., not Maxim.), is noteworthy because it is one of the earliest of all trees to leaf out in spring. G.F. 1:295. Var. *plena*, Hort., is a double-fl. form. Variable in its foliage. Makes a shapely tree 10–20 ft. tall. Var. *cornuta*, Henry (*P. cornuta*, Steud.), of the Himalayas, has lvs. rounded at base and bluish green beneath with reddish hairs in the axils of the veins: pedicels and long racemes pubescent: fr. $\frac{1}{2}$ in. or less diam., the stone smooth. *P. Lauchedna*, Bolle, is a hybrid of this and *P. virginiana*.

75. *Grayana*, Maxim. (*P. Pádus* var. *japonica*, Miq.), is allied to *P. Pádus*. A small tree, 20–30 ft. high, with a slender trunk, ample membranaceous long-pointed setaceous serrate lvs., biglandular at the base but without glands on the petioles, a peculiarity which best distinguishes this species, although the hair-like teeth of the lvs. are characteristic and apparently constant: style long rather than short as in *P. Pádus*. Japan.

76. *Ssidi*, Schmidt (*Pádus Ssidi*, Schneid.). Smaller-fl. than *P. Pádus*, with a smooth or only obscurely roughened stone: lvs. ovate, long-acuminate, strongly serrate with narrow teeth, not papillose beneath; petiole $\frac{1}{2}$ – $1\frac{1}{2}$ in. long, with usually 2 or more glands at apex: raceme 4–7 in. long, glabrous; petals white, about $\frac{1}{2}$ in. long, equaling the stamens. Manchuria, Saghalin, Japan.

AA. *Laurocerasus*: lvs. persistent (evergreen): fls. in spring in the axils of the lvs. of the previous year. (Cherry-laurels.)

B. Racemes longer than the lvs.

77. *lusitánica*, Linn. (*Pádus lusitánica*, Mill. *Laurocerasus lusitánica*, Roem.). PORTUGAL LAUREL. Tree, 20 ft. tall, but usually grown as a tub-plant and comparable with *Laurus nobilis*: lvs. thick and leathery, ovate-lanceolate to long-lanceolate, sharp-serrate: fls. white, in racemes that exceed the lvs., appearing in late spring or early summer: fr. round-oval, nearly black, small. Spain, Portugal, and Canary Isls.—It is a small tree in its native places, but becomes a bush farther north. It is sometimes planted in the open in our southern states, but in northern parts it is wintered inside. There is a form (var. *angustifolia*, Hort.) with narrow lvs., another (var. *myrtifolia*, Nichols.) with small lvs. and compact habit, and another (var. *aureo-variegata*, Hort.) with yellow-variegated lvs., and one (var. *variegata*, Nichols.) with lvs. variegated white. Var. *azórica*, Nichols., is a free grower with red sts.: lvs. more coriaceous and more coarsely serrate than the type: racemes short and densely fl.: shrubby. Azores. G. 30:123. Var. *Híza*, DC. Lvs. narrower and more oblong than in the type, about 5 in. long: racemes 6–8 in. long, the fls. less crowded. Madeira and Canary Isls.

BB. Racemes not longer than the lvs.

C. Calyx-lobes toothed or undulate.

78. *Laurocerasus*, Linn. (*Cerasus Laurocerasus*, Loisel. *Pádus Laurocerasus*, Mill. *Laurocerasus officinalis*, Roem.). CHERRY-LAUREL. ENGLISH LAUREL. Bush or small tree (reaching 10 ft.) with handsome evergreen foliage: lvs. coriaceous and glossy, short-stalked, oval, lanceolate, oblong-elliptic or oblanceolate, narrowed into a short point, remotely serrulate, with 2–4 glands at the base of the blade: fls. small, white, in axillary or terminal short racemes in spring, the calyx-lobes 3-toothed: fr. ovoid-acute, small, blackish. S. E. Eu. to N. Persia. Gn. 50, p. 313.—One of

the most popular broad-ld. evergreen plants in Eu., and somewhat planted in the southern states. It is also grown in tube and used for house-decoration. Some of the forms will stand as far north as Washington, and var. *schipkaensis* is hardy in Cent. N. Y. When grown in the open, the cherry-laurel should be allowed to ripen its wood thoroughly before winter sets in. Protection from severe winds is always desirable. The plant may be prop. by means of long cuttings of ripe wood; also by layers. Named varieties are worked on common stocks. The cherry-laurel is very variable. Some of the many horticultural forms are as follows: Var. *angustifolia*, Nichols., lvs. very long and narrow, and plant hardy as far north as Washington; var. *Bérinii*, with very broad lvs.; var. *camelliaefolia*, Nichols., with recurved lvs.; var. *caucásica*, Hort., and var. *cólchica*, Hort., with slender twigs and dark foliage which is gray-green beneath, also hardy; var. *japónica*, Hort., a narrow-ld. form, like var. *angustifolia*; var. *latifolia*, Hort., with broad lvs., hardy at Washington; var. *versaillesensis*, Hort., also with broad foliage; var. *microphylla*, Hort., with small, narrow lvs., only 4-5 in. long; var. *rotundifolia*, Nichols., with short-oblong blunt lvs. (Gn. 28, p. 405); var. *parvifolia*, Nichols., lvs. only 1½ in. long and ½ in. broad, coarsely serrate; shrub; var. *schipkaensis*, Spaeth, with small nearly or completely entire lvs. dark green above and very light green beneath, shrubby, hardy in N. Y. (R.H. 1905, p. 409. G.W. 5, p. 177, var. *schipkaensis Zabeliana*); var. *variegata*, Nichols., lvs. marbled or blotched with dull white.

79. *caroliniana*, Ait. (*Prunus sempervirens*, Willd. *Cerasus caroliniana*, Michx. *Padus caroliniana*, Mill. *Laurocerasus caroliniana*, Roem. WILD ORANGE. MOCK ORANGE of the S. Tree, 20-40 ft.: lvs. oblong-lanceolate-acuminate, usually entire but sometimes remotely spinose-serrulate, thick, dark green and shining above, the margins usually somewhat revolute; fls. cream-colored, in short rather close racemes, the calyx-lobes with undulate margins: fr. ½ in. long, oblong-pointed, black, and shining, persisting for a year. S. C. to Fla. and Texas, in stream-valleys and near the coast. S.S. 4:160.—A handsome evergreen, prized for planting in the S. Blooms from Feb. to April.

80. *sphaerocarpa*, Swartz (*Laurocerasus sphaerocarpa*, Roem.). Small glabrous tree, 30-40 ft.: lvs. elliptic, 2-4 in. long, acuminate, shining, entire, the petioles slender but less than ½ in. long: racemes rather dense, shorter than the lvs., the slender pedicels subtended by deciduous bracts; sepals or calyx-lobes lacinate and acute, deciduous, much smaller than the reflexed white petals which are yellow near base within: fr. nearly globular, pointed at apex, ⅓-½ in. diam., orange. S. Fla., W. Indies, Brazil.

cc. Calyx-lobes entire.

81. *ilicifolia*, Walp. (*Cerasus ilicifolia*, Nutt. *Laurocerasus ilicifolia*, Roem.). ISLAY. WILD CHERRY. EVERGREEN CHERRY. MOUNTAIN HOLLY. Evergreen bush or small tree, rarely becoming 30 ft. tall, with a dense crown: lvs. holly-like, ovate to ovate-lanceolate, obtuse, acute, or sometimes even acuminate, mostly broad and sometimes rounded at the base, the margins coarsely spiny-toothed, the blade thick and shining: fls. white, in slender racemes less than 2 in. long in spring, about ½ in. across: fr. rather large (sometimes ½ in. long), nearly globose, purple or nearly black; stone ovate. San Francisco to Low. Calif. Gn. 3, p. 131. S.S. 4:162. G.F. 5:475 (tree).—A most worthy garden-plant.

82. *Lyonii*, Sarg. (*Laurocerasus Lyonii*, Eastw. *Prunus occidentalis*, Lyon, not Swartz. *P. ilicifolia* var. *occidentalis*, Brandeg. *P. integrifolia*, Sarg., not Walp. *P. ilicifolia* var. *integrifolia*, Sudw.). ISLANDS

CHERRY. Lvs. longer and more acuminate, usually entire: fr. larger. Islands off the coast of S. Calif. (Santa Cruz and Santa Catalina). S.S. 4:163.—Considered to be more desirable as a garden-plant than No. 81. It grows rapidly under cult., making a compact very dark green crown. Useful also in pots and tubs. *P. occidentalis*, Swartz, a different plant, grows from Cuba to Trinidad. It is not in the trade. Grisebach describes it as a high tree: lvs. oblong or ovate-oblong, rounded at the base, bluntish, with 2 glandular spots at the base beneath: racemes lateral, puberulous or glabrous: fr. ovoid, slightly apiculate, nearly 1 in. long, purple. The fr. is said to be "of very fine flavor."

P. bicolor, Koehne. Allied to *P. Padus*. Tree, to 40 ft.: branchlets finely velutinous: lvs. obovate-oblong, acuminate, subcordate or rounded at base, serrulate, glabrous and whitish beneath, 2-4 in. long: fruiting raceme to 5 in. long: fr. globose, ½ in. across. W. China.—*P. canadensis*, Koehne. Allied to *P. Maximowiczii*. Tree, to 30 ft.: lvs. obovate, acuminate, usually rounded at base, doubly serrate, finally glabrous, 1½-3¼ in. long: fls. white, about ½ in. across, in 5-8-fld. racemes: fr. ovoid, red. W. China.—*P. conspersa*, Koehne (*P. Zappcyana*, Koehne). Allied to *P. lobulata* (and has been cult. as *P. subhirtella*). Shrub, to 15 ft.: lvs. rhombic-oblong to obovate-oblong, acuminate, rounded at the base, doubly incised-serrate, nearly glabrous, 1-3 in. long: fls. white, 1-2, precocious, about ½ in. across; pedicels and calyx glabrous: fr. dark red or black. Cent. China.—*P. consociiflora*, Schneid.—*P. salicina*.—*P. cyclocladus*, Koehne (subgen. *Cerasus*). Tree, to 25 ft.: lvs. obovate-oblong, acuminate, rounded at base, sharply simply or doubly serrate, at first sparingly pubescent on the veins, 2-4 in. long: fls. umbellate, 3-4, pink, 1½ in. across; sepals reflexed: fr. subglobose, red, ½ in. across. Cent. China.—*P. delavayi*, Koehne (subgen. *Amygdalus*). Spiny shrub, to 12 ft.: lvs. usually fasciated, oblong to oblanceolate, acute or obtuse, cuneate at the base, crenulate, glabrous, ¼-1½ in. long: fls. subsessile; sepals roundish: fr. roundish, slightly compressed, about ¼ in. across, greenish, densely tomentose, finally dehiscent; stone slightly compressed, keeled, slightly rugose. W. China.—*P. Dielsiana*, Schneid. (subgen. *Cerasus*). Shrub or tree, to 30 ft.: lvs. oblong, abruptly acuminate, cuneate or rounded at the base, simply or doubly serrate, pubescent beneath, 3-6 in. long: fls. umbellate, 3-5, with persistent involucre, white or pink, 1½ in. across; sepals reflexed, oblong to lanceolate: fr. globose, red, ½ in. across. Cent. China.—*P. diademata*, Koehne. Allied to *P. Maximowiczii*. Shrub or tree, to 35 ft.: lvs. ovate or obovate, acuminate, usually rounded or cordate at base, unequally serrate, glabrous, 2-4 in. long: fls. white, ½ in. across, in 3-9-fld. racemes: fr. subglobose, ½ in. across. Cent. China.—*P. glyptodryas*, Koehne. Allied to *P. lobulata*. Tree, to 30 ft.: branchlets pubescent: lvs. oblong to obovate-oblong, acuminate, usually rounded at base, deeply doubly serrate, pubescent beneath, 2-4½ in. long: fls. umbellate: fr. globose, ½ in. across, dark red; stone reticulate and ribbed. W. China.—*P. Jacquemontii*, Hook. f. Allied to *P. prostrata*. Low shrub, glabrous: lvs. elliptic-oblong, acute or short-acuminate, cuneate at base, serrate, light green beneath, ¼-1½ in. long: fls. 1-3, short-stalked, pink, ½ in. across; calyx tubular: fr. ovoid, ½ in. long, dark purple. W. Himalayas. B.M. 6978.—*P. macrophylla*, Sieb. & Zucc. Allied to *P. Laurocerasus*. Evergreen tree, to 30 ft.: lvs. oblong, acuminate, broadly cuneate at base, serrulate, glabrous, 4-7 in. long: fls. white, in dense racemes 1-1½ in. long: fr. ovoid, ½ in. long. S. Japan. S.I.F. 1:29.—*P. mira*, Koehne. Allied to *P. Persica*. Tree, to 30 ft.: lvs. lanceolate, long-acuminate, rounded at base, crenulate-serrulate, villous beneath along the midrib, otherwise glabrous, 2-4 in. long: fr. short-stalked, subglobose, 1½ in. across, tomentose, edible; stone ovate, compressed, keeled, smooth. W. China. Differs from all peaches in its smooth stone. Hardy at Arnold Arboretum.—*P. perulata*, Koehne (subgen. *Padus*). Tree, to 40 ft.: lvs. elliptic to oblanceolate, acuminate, rounded or broadly cuneate at base, serrulate, sparingly pubescent beneath, 2½-4½ in. long: racemes 2-3 in. long, velutinous, with a persistent involucre at base, leafless: fr. globose, ½ in. across; calyx persistent. W. China.—*P. pleiocerasus*, Koehne. Allied to *P. Maximowiczii*. Tree, to 25 ft.: lvs. obovate-oblong, caudate-acuminate, rounded or cuneate at base, unequally serrate, glabrous or nearly so beneath, 1¼-3½ in. long: fls. white, in 4-7-fld. racemes: fr. globose, dark red or black. W. China.—*P. pleuropatera*, Koehne. Allied to *P. lobulata*. Tree, to 30 ft.: branchlets hairy: lvs. obovate to rhombic-oblong, acuminate, usually cuneate at base, incisely doubly serrate, pubescent beneath on the veins, ¾-2½ in. long: fr. usually solitary, subglobose, ½ in. long, black; stone sulcate and foveolate. W. China.—*P. polytricha*, Koehne. Allied to *P. Maximowiczii*. Tree, to 30 ft.: branchlets villous: lvs. obovate to obovate-oblong, caudate, usually rounded at base, doubly serrate, pubescent on both sides, 1½-3 in. long: frs. 1-2 on a bracted peduncle ½-½ in. long, ovoid, red, ½ in. long: pedicels villous, about 1 in. long. Cent. China.—*P. pubigera*, Koehne (*P. pubigera* var. *Potaninii*, Koehne). Allied to *P. Padus*. Tree, to 60 ft.: branchlets minutely velutinous: lvs. obovate-oblong, short-acuminate, subcordate or cordate at the base, minutely serrulate, glabrous and whitish beneath, 1½-4¼ in. long: petioles puberulous: racemes 3-6 in. long: fr. about ½ in. across. W. China. Var. *Pritii*, Koehne. Lvs. cuneate or rounded at base; petioles glabrous. Var. *obovata*, Koehne. Lvs. obovate, rounded at base; petioles glabrous.—*P. rufomicans*, Koehne (subgen. *Padus*). Tree, to 80 ft.: lvs. of flowering branchlets lanceolate to oblong-lanceolate, about 2 in. long, of sterile branches usually obovate, 3-4 in.

long, sharply serrulate, rufous-tomentose beneath: fruiting raceme 5 in. long, glabrous: fr. subglobose, $\frac{3}{4}$ in. across. W. China.—*P. sericea*, Koehne (*P. napaulensis* var. *sericea*, Batal). Tree, to 80 ft.: lvs. elliptic to oblong, rounded or cuneate at base, remotely serrate, white-tomentose at first, later grayish tomentose, 3–5 in. long: racemes 4–5 in. long, densely short-pilose: fr. subglobose, $\frac{3}{4}$ in. long, black. W. China.—*P. stellipila*, Koehne (subgen. *Padus*). Tree, to 20 ft.: lvs. elliptic to narrow-oblong, long-acuminate, broadly cuneate or nearly rounded at base, sharply serrate, sparingly pubescent beneath, 2–4 in. long: racemes upright, $1\frac{3}{4}$ –2 in. long, without lvs. at the base: fr. globose, $\frac{1}{4}$ in. across. Cent. China.—*P. tangutica*, Koehne (*Amygdalus communis* var. *tangutica*, Batal). Spiny shrub: lvs. fascicled, lanceolate, obtuse or acutish, crenulate-serrulate, 1–2 in. long: fls. sessile, about 1 in. across: fr. subglobose, $\frac{1}{4}$ in. across, somewhat compressed, rather dry; stone irregularly furrowed. N. W. China.—*P. tatsienensis*, Batal. Allied to *P. Maximowiczii*. Tree: lvs. ovate to obovate, acuminate, serrulate, $1\frac{1}{2}$ –2 $\frac{1}{2}$ in. long: fls. white, $\frac{1}{4}$ in. across in 3–7-fld. racemes with large leafy bracts. W. China. Var. *signat-denia*, Koehne. Tree, to 30 ft., quite glabrous: lvs. obovate-oblong, caudate, cuneate or rounded at base: fr. globose, dark red, $\frac{1}{4}$ in. across. W. China.—*P. pendula*, Koehne (subgen. *Padus*). Tree, to 35 ft.: lvs. oblong-obovate to obovate-oblancoate, acuminate, cuneate or nearly rounded at base, sharply serrate, reticulate beneath, glabrous except the bearded axils, 2 $\frac{1}{2}$ –4 $\frac{1}{2}$ in. long: racemes without lvs. at base, $1\frac{1}{4}$ –4 in. long: fr. globose, about $\frac{1}{4}$ in. across. Cent. China.—*P. Wilsonii*, Koehne (*Padus Wilsonii*, Schneid.). Tree, to 30 ft.: lvs. elliptic-oblong to obovate-oblong, acuminate, usually cuneate at base, remotely serrate, whitish pubescent beneath, 3 $\frac{1}{2}$ –5 in. long: racemes pubescent, 5–6 in. long: fr. ovoid, $\frac{1}{4}$ in. long, black. Cent. China. Var. *leiodictys*, Koehne. Lvs. closely serrulate, grayish beneath; racemes glabrous.—*P. Zappeyana*, Koehne=*P. concinna*.

L. H. B.

PSAMMA: *Ammophila*.

PSEUDERANTHEMUM (Greek, false *Eranthemum*, the genus resembling *Eranthemum* from which it was separated). *Acanthaceae*. Smooth bushes or shrubs with often coarse-toothed leaves and mostly brilliant colored flowers; glasshouse subjects.

Inflorescence racemose, 1–3-branched or simple in the axils of the bracts; fls. long-tubed, corolla with the limb spreading; lobes almost equal or the 2 rear ones smaller; stamens short, fastened in the tube, 2 staminoids present, true stamens 4 or less.—Sixty to 70 species, occurring in the tropics of both hemispheres. *Pseuderanthemum*, as characterized by Lindau in Engler and Prantl, *Pflanzenfamilien* IV 3b:330, includes *Eranthemum* of Auth. not of Linn., and *Eranthemum* of Linn. is used for *Dadalanthus* as treated in this work (see Vol. II, p. 950); and this constitutes the accepted treatment. There are a large number of horticultural species, a partial list of which occurs under *Eranthemum* (see Vol. II, p. 1126). Many of the species are cult. for their variegated foliage while others are grown for their fls. Warmhouse plants, prop. by cuttings any time from March to June.

Andersonii, Lindau (*Eranthemum Andersonii*, Mast.). Lvs. large, lanceolate, acute at both ends, glabrous: spike 10 in. long, lower clusters distant, many-fld., upper few-fld., continuous; corolla white, midlobe of lower lip spotted with purple; ovary ovoid-oblong. Asia(?). B.M. 5771. Gn. 45:11. G.Z. 25:49. See p. 1126.

cinnabarinum, Radlkf. (*Eranthemum cinnabarinum*, Wall.). Lvs. large, elliptic, acuminate at both ends: panicles compound, stout; corolla crimson, tube linear to the apex, sometimes a yellowish spot on the middle lobe of the lower lip. Burma. B.M. 5921 (as *E. cinnabarinum* var. *ocellatum*, the variety differing in the maculate lvs.).

laxiflorum, Hubb. (*Eranthemum laxiflorum*, Gray). Two to 4 ft. high, glabrous: lvs. oval or lanceolate-oblong: cymes few or many-fld., axillary, usually with a pair of lf.-like bracts; corolla salver-shaped, reddish purple; ovary oblong, conical, glabrous. Fiji Is. B.M. 6336. See p. 1126.

lilacinum, Stapf. About 3 ft. high: lvs. lanceolate, long-acuminate: infl. paniculate; corolla-tube narrow, straight, almost white, limb 2-lipped, lilac-blue with a white or yellowish blotch, midlobe of lower lip red-speckled. Malaya. B.M. 8446.

malaccense, Lindau (*Eranthemum malaccense*, C. B. Clarke). Three to 5 ft. high: lvs. lanceolate to elliptic-

lanceolate, base cuneate: infl. $\frac{1}{2}$ –2 in. long, numerous-fld., many opening together in whorls, finally raceme-like; corolla salver-shaped, tube nearly straight, pale violet, limb 2-lipped, pale violet or violet-white with red specks on the midlobe of the lower lip. Malaya. B.M. 8368.

pulchellum, Merr. (*P. bicolor*, Radlkf. *Eranthemum pulchellum*, Hort., not Auth. *E. bicolor*, Schrank). About 3 ft. high: lvs. thin, elliptic-ovate to oblong-lanceolate, acute or acuminate: corolla white, middle lobe of lower lip with a large purple spot. Malaya and Polynesia.

reticulatum, Radlkf. (*Eranthemum reticulatum*, Hort. *E. Schomburgkii*, Hort.). Lvs. opposite, lower ovate-lanceolate, dark green above with arching golden nerves, upper narrower, reticulated golden yellow and green: corolla white, speckled with blood-red around the mouth of the tube. Austral. or Polynesia (?). B.M. 7480. I.H. 26:349. See p. 1126.

seticalyx, Stapf (*Eranthemum seticalyx*, C. B. Clarke). Erect, somewhat hirsute: branches terete: lvs. ovate, acuminate: infl. spicate, terminal also in upper lf.-axils; calyx with white-spreading bristles; corolla salver-shaped, tube long, pale red, limb cinnabar-red above, paler beneath, 1 in. across. Trop. Afr. B.M. 8244.

tuberculatum, Radlkf. (*Eranthemum tuberculatum*, Hook. f.). Small shrub, much branched: lvs. small, elliptical or subovate: fls. very numerous, axillary, solitary, pure white, almost sessile. Polynesia. B.M. 5405. See p. 1126.

F. TRACY HUBBARD.

PSEUDOLARIX (Greek, *pseudos*, false, and *Larix*; being similar to, but not a true larch). Syn., *Laricopsis*. *Pinaceae*. GOLDEN LARCH. Ornamental tree, grown for its handsome feathery foliage.

3244. *Pseudolarix Kaempferi*. ($\times \frac{1}{2}$)

Deciduous, with horizontally spreading whorled branches: lvs. linear, in dense clusters on short spurs, those of the young shoots spirally arranged: staminate fls. catkin-like, slender-stalked and clustered at the end of short spurs; cone short-stalked, pendent, with ovate-lanceolate deciduous scales and with bracts about half as long as the scales; each scale with 2 seeds with the wings nearly as long as the scale.—The only species is known wild only from a restricted region in E. China, where it grows in the mountains at an altitude of about 3,000–4,000 ft. It is closely allied to *Larix*, but differs by the stalked, pendulous, clustered, staminate fls. and by the deciduous cone-scales, which separate from the axis at maturity, as in the fir.

The golden larch is a beautiful tree with its long, spreading branches pendulous at the extremities and clothed with light green feathery foliage turning to a clear yellow in fall. The tree seems to remain free from insect pests and fungous diseases and is hardy in Massachusetts, and probably farther north. It requires a sunny open position and a well-drained moderately moist soil; it does not thrive nor look well if crowded by other trees. The golden larch should be raised only from seeds. If grafted on its own roots or on the common larch, as is sometimes done, it rarely grows into a symmetrical tree.

Kämpferi, Gord. (*P. Fortunei*, Mayr. *Larix Kämpferi*, Fort. *Laricopsis Kämpferi*, Kent). Fig. 3244. Tree, becoming 130 ft. high: lvs. linear, acuminate, soft, light green, bluish green beneath, $1\frac{1}{2}$ –3 in. long and $1\frac{1}{2}$ lines broad: staminate fls. yellow, about $\frac{1}{4}$ in. long, slender-stalked; pistillate fls. about $\frac{1}{4}$ in. long: cone ovate, reddish brown, $2\frac{1}{2}$ –3 in. long, $1\frac{1}{2}$ –2 in. broad; scales triangular, ovate-lanceolate, cordate at the base, emarginate at the apex, woody; bracts ovate-lanceolate, much smaller than the scales; seeds about $\frac{1}{2}$ in. long. F.S. 17:1777, 1778. R.H. 1868:331; 1871, pp. 608, 609. G.C. II. 19:88. Gn. 8, p. 325; 29, p. 397. G.W. 3, p. 123; 14, p. 603. F.E. 19:236 (pl. 94). B.M. 8176. Var. *nana*, Beissn. Dwarf form, cult. in China and Japan; without much decorative value.

ALFRED REHDER.

PSEUDOPANAX (*false Panax*). *Araliaceae*. A small and horticulturally unimportant group of greenhouse aralias grown for their foliage, flowers having never developed in cultivation, so far as known, in America.

Glabrous shrubs or rarely trees in cult.: lvs. digitately compound, and sometimes simple, the juvenile lvs. quite unlike mature specimens: fls. dioecious, in racemose or paniculate umbels; calyx-limb entire or toothed; corolla of 5 distinct, valvate petals; stamens 5; ovary 5-celled: fr. fleshy.—Only 6 species are known, as here understood all from the islands of New Zealand. Cult. as in *Disygotheca*.

crassifolium, Koch (*Aralia crassifolia*, Soland. *Disygotheca crassifolia*, Taylor). In cult. a shrub, often a tree 20–40 ft. high in nature: lvs. very variable, those of seedlings rhomboid to ovate-lanceolate; of young, unbranched plants very narrow-linear, sometimes 1-foliate and rigid, erect or sometimes 3–4-foliate: umbels terminal, compound: fr. globose, $\frac{1}{2}$ in. diam.

P. Kerchovednum, Hort. (*Aralia Kerchoveana*)=*Disygotheca*. See *Polyscias* for related plants.

N. TAYLOR.

PSEUDOPHŒNIX (Greek, *false Phoenix*). *Palmaceae*, tribe *Arëceae*. Until very recently only one recognized species, a pinnate-leaved palm discovered in 1886 on Elliott's Key, Florida, and distinguished from all other North American palms by its scarlet-orange fruit, which is about the size of a cherry.



3245. Fruit of *Pseudophœnix Sargentii*.
($\times \frac{1}{2}$)

Unarmed palms, with spindle-shaped trunk: spadix shorter than the lvs., pendulous, branched, almost zigzag: female fl. with calyx small, spreading, somewhat denticulate; petals 3, ovate, obtuse, green, bent back; staminodia 6, distinctly dark purple at the top: fr. a drupe, stipitate, containing 1–3 globular carpels. Allied to royal palm (*Oreodoxa*), but differing in color of fr. and in spreading rather than ascending or erect spadix-branches.

Sargentii, Wendl. Fig. 3245. Trunk slender, 20–25

ft. high, 10–12 in. thick: lvs. abruptly pinnate, 4–5 ft. long; pinnae lanceolate, acuminate, 12–16 in. long, bright green above, glaucous beneath, folded backward at the very base: spadix appears from among the lvs.; main and secondary branches light yellow-green and flattened: fr. usually 3-lobed, $\frac{1}{4}$ – $\frac{1}{2}$ in. thick, bright orange-scarlet. Fla. Keys and the larger W. Indies. G.F. 1:353, 355 (adapted in Fig. 3245).—The tree is somewhat planted in S. Fla. (see p. 2445), but the plantings in S. Calif., appear to have been lost.

P. vinifera, Bec. (*Euterpe vinifera*, Mart.), of Haiti, is apparently not in cult. Evidently this palm was once common in that island, but probably it has been destroyed by the natives who fell the trees to extract the saccharine juice of the inflated part of the trunk and from which a fermented drink is made. The trunk is apparently more ventricose than that of *P. Sargentii*, the spadix is more diffuse and the branchlets more elongate, and the fr. pedicellate but 1-seeded.

N. TAYLOR.†

PSEUDOTSUGA (Greek, *false Tsuga*). Syn., *Abietis*. *Pinaceae*. Ornamental woody plants grown for their regular pyramidal habit and evergreen foliage; also important timber trees.

Tall evergreen trees with whorled branches: lvs. more or less 2-ranked, linear, flattened, green and grooved above, with a stomatiferous white band on each side of the prominent midrib beneath, with only 1 vascular bundle in the center: staminate fls. axillary, cylindric: cones pendent, ovate-oblong, maturing the same season; scales rounded, rigid, persistent; bracts longer than the scales, 2-lobed at the apex with the midrib produced into a rigid awn; each scale with 2 nearly triangular seeds with a wing shorter than the scale.—Four species, 2 in W. N. Amer., 1 in Japan, and 1 in W. China. Very similar in habit and foliage to *Abies*, from which *Pseudotsuga* without cones can be easily distinguished by the more slender and flexible lvs. and the elongated, ovate or ovate-oblong, acute, not resinous winter buds; from *Tsuga* it may be distinguished without cones by the smooth branches, not roughened by the persistent lf.-bases, and the longer lvs. The light red or yellow wood is hard and durable and much used for construction, for railway ties and for masts. The bark is sometimes used for tanning leather.

The Douglas spruce, which is the only species well known in cultivation, is a tall tree of symmetrical habit with regularly whorled branches clothed with more or less two-ranked linear leaves, with orange staminate and purplish pistillate catkins and with pendulous medium-sized cones of somewhat bristly appearance on account of the protruding bracts, falling off as a whole. It is one of the tallest and most important forest and timber trees of western North America, and in its forms of the higher altitudes it is hardy as far north as Canada. When it finds a congenial home it is among the most desirable conifers for park planting and it grows rapidly, but where rapid growth is not desired, the var. *glauca* may be planted, which is of much slower growth and more compact habit. It thrives best in a porous sandy loam, and its cultivation does not differ from that of *Picea*, which see. Varieties may be grafted on the type.

The Douglas spruce is a tree for the million. It would be difficult to overrate its beauty. As a forest tree it perhaps produces a greater crop of lumber to the acre than any other species. It probably grows faster than any other conifer. Indeed, the complaint is sometimes made that it grows too fast to make a compact lawn tree. It is desirable to have groups of Douglas spruce, because the foliage is so soft that single specimens are sometimes injured by high winds. Specimens planted on the prairies without protection from hot winds may sometimes have their buds injured by late spring frosts. It is, of course, a mistake to use this kind of spruce for a windbreak. The Douglas spruce is generally propagated by seeds. Seeds of conifers gathered on the Pacific slope are tender, while those gathered in Colorado produce hardy trees which endure

both drought and cold. Unlike the firs, the Douglas spruce has fine fibrous roots like the Norway spruce and transplants as readily. The writer has transplanted many stocky young trees growing in the open to the nursery and has saved 90 per cent of them. They seemed to thrive as well as nursery-grown Norway spruces of the same size. The yield of seed from a wagon-load of cones is light, and it is somewhat difficult to grow seedlings. In some circumstances it will be cheaper in the end to procure young trees. The Douglas spruce is remarkable for its wide variation in form and color. The needles may be short or long, light green, dark green, or have a bluish or silvery cast. The deep blue and silvery foliage is characteristic of the deep gorges of high altitudes. (C. S. Harrison.)

taxifolia, Brit. (*P. Douglasii*, Carr. *P. mucronata*, Sudw. *P. Lindleyana*, Carr. *Abies Douglasii*, Lindl. *Abietia Douglasii*, Kent). DOUGLAS SPRUCE. RED FIR. Fig. 3246. Pyramidal tree, attaining 200 ft. and sometimes more, with a trunk becoming 12 ft. diam. clothed with ridged dark red-brown bark: branches horizontal, with



3246. *Pseudotsuga taxifolia*. ($\times \frac{3}{4}$)

pendulous branchlets: lvs. linear, straight or curved, obtuse, slender and flexible, dark green or bluish green, $\frac{3}{4}$ – $1\frac{1}{4}$ in. long; staminate catkins orange, pistillate reddish: cones pendulous, oval-ovate, with broad rounded scales and much exserted bracts 2– $4\frac{1}{2}$ in. long; seed $\frac{1}{4}$ in. long, with broad wing, light reddish brown. Brit. Col. to Mex., west to Mont. and Colo. S.S. 12:607. G.F. 10:295. Gn. 31, p. 288. R.H. 1868: 151. M.D. 1901:1; 1909, p. 69. G.W. 10, p. 565; 13, p. 411. There are many forms in cult. Var. *viridis*, Schneid. (*P. Douglasii viridis*, Schwerin), is the typical green-lvd. rapid-growing form. Var. *cæsia*, Schneid. (*P. Douglasii cæsia*, Schwerin), agrees with the type except that the lvs. are bluish green; it seems to be somewhat harder. Var. *glauca*, Schneid. (*P. Douglasii glauca*, Mayr. *P. glauca*, Mayr). Of more compact habit: branches more ascending: lvs. shorter, bluish green: cones smaller, with often reflexed bracts. Colo. G.C. III. 36:53. Hardier than the type, but of slower growth. Var. *argentea*, Schneid. (*P. Douglasii argentea*, Koster). Similar to the preceding, with almost silvery white foliage. *P. Douglasii glauca elegans*,

Mottet, is scarcely different. R.H. 1914, p. 344. Var. *glaucescens*, Schneid. (*P. glaucescens*, Baily). With bluish white foliage and pendent branchlets. N. Mex. R.H. 1895:88; 1903, p. 208. Var. *pendula*, Schneid. (*P. Douglasii pendula*, Engelm.). With pendulous branches and dark green foliage. Var. *glauca pendula*, Schneid. (*P. Douglasii glauca pendula*, Beissn.). With pendulous branches and bluish green or bluish white foliage. Var. *fastigiata*, Schneid. (*P. Douglasii fastigiata*, Carr.). A narrow conical pyramid with ascending branches and shorter lvs. Var. *compacta*, Schneid. A compact conical form with short and dense foliage. Var. *globosa*, Rehd. (*P. Douglasii globosa*, Beissn.). A dwarf globose form. M.D. 1905, p. 75. Var. *Frétsii* (*P. Douglasii Frétsii*, Beissn.). Compact: lvs. very much shortened. Var. *Moerheimii* (*P. Douglasii Moerheimii*, Ruijs). With compact habit and finer deeper blue foliage than in the type. There are also some forms with variegated lvs.

P. japonica, Beissn. (*Tsuga japonica*, Shirasawa). Tree, to 60 ft.: branches glabrous: lvs. shorter, emarginate, often curved: cones smaller, $1\frac{1}{2}$ –2 in. long, with reflexed bracts. Japan. G.C. III. 45:307. S.I.F. 1:7. Has proved tenderer than *P. taxifolia* at the Arnold Arboretum.—*P. macrocarpa*, Mayr (*P. Douglasii* var. *macrocarpa*, Engelm. *Abies macrocarpa*, Vasey). Tree, to 60 or 80 ft., with remote and usually pendulous branches: lvs. acute, bluish gray: cones 4– $6\frac{1}{4}$ in. long, with shorter bracts; seeds $\frac{1}{4}$ in. long. S. Calif. S.S. 12:608. G.F. 10:25. Seems not yet intro.; not hardy N.—*P. sinensis*, Dode. Tall tree: branches pubescent: lvs. emarginate: cones about 2 in. long. S. W. China. Probably tender.—*P. Davidiana*, Bertrand, *P. Fortunei*, Carr., and *P. jezoensis*, Bertrand—*Keteleeria*.

ALFRED REHDER.

PSIDIUM (Greek, *psidion*, the pomegranate). *Myrtaceæ*. A large group of tropical and subtropical trees and shrubs, all native to America, many of which produce edible fruits. The common guava of the tropics, *P. Guajava*, is the best known. It has become naturalized in many parts of Asia and Africa. See *Guava*.

Leaves opposite, petiolate, glabrous, pubescent or tomentose, pinnately veined: fls. usually rather large, whitish, on axillary or lateral 1–3- (rarely many-) fld. peduncles; calyx-tube urceolate or pyriform, lobes 4–5, persistent; calyx sometimes closed before anthesis and splitting irregularly into 2–5 lobes; petals 4 or 5, spreading; stamens numerous, disposed in many series and inserted upon the disk, filaments filiform, anthers oblong or linear, basifixed, longitudinally dehiscent; ovary with 2–7, commonly 4, locules, the style slender, stigma peltate or subcapitate: fr. a berry, ovoid, globose or pyriform, commonly 1–3 in. long, yellow to red in color, sometimes green, crowned with the calyx-limb; seeds few to numerous, small, hard.—About 150 species. The genus is somewhat confused and in need of further study. A large number of species doubtless exist in S. and Cent. Amer., which have not as yet been described. The genus is allied to the myrtles (*Myrtus*), the pomegranate (*Punica*), and the various *Eugenias*, of which a number are cult. in the tropics for their frs. The following treatment includes the principal ones known to horticulture.

A. Branchlets 4-angled.

Guajava, Linn. **GUAVA**. Fig. 3247. An arborescent shrub or small tree, up to 25 or 30 ft. high, the trunk rather slender, usually dividing close to the ground, the bark scaly, smooth, greenish brown: lvs. oblong-elliptic, elliptic, or oval, 3–6 in. long, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. broad, chartaceous, rounded to acute at apex, rounded at base, light green, finely pubescent below, the venation conspicuously impressed above and raised below; petiole $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long: fls. produced on branchlets of recent growth, solitary or on 2- or 3-fld. peduncles, axillary; pedicel $\frac{3}{4}$ in. long, bearing at its upper end 2 small, slender bracts; calyx-tube oblong-ovate, slightly constricted above the ovary; calyx closed before anthesis, splitting into 2–4 irregular segms., whitish and sparsely hairy within; petals broadly oval, about $\frac{3}{4}$ in. long, thin and delicate, white; stamens erect or spreading,

in a broad cluster, the filaments about $\frac{1}{16}$ in. long, anthers pale straw-colored; style about $\frac{3}{16}$ in. high, stigma subcapitate, greenish; fr. globose, ovoid or pyriform, 1-4 in. long, commonly yellowish in color with flesh varying from whitish or yellowish to deep pink; flavor sweet or somewhat acid, with a pronounced musky aroma; seeds usually numerous, reniform or flattened. Flowers most abundantly in spring and produces the main crop of frs. in Aug. and Sept. Mex. and Cent. Amer., perhaps as far south as Peru.—This species is variable, and occurs in a wide range of horticultural forms. The two species *pyriferum* and *pomiferum* of Linnaeus are considered to be nothing more than round and pear-shaped varieties, and are no longer accorded botanical standing. A large guava, which appears to be a horticultural form of this species, was formerly offered by Reasoner Bros. of Fla. under the name of *P. guineense*, but is now being called Guinea guava and referred to *P. Guajava*. It is a large sweet fr. of excellent flavor, with unusually few seeds and thick flesh. In Calif. this variety has been called *P. guianense*. A round red-fleshed guava intro. to Calif. by Franceschi under the name of *P. aromaticum* also appears to be a horticultural variety of *P. Guajava*. The variety Perico has been disseminated in Fla.; other forms are commonly listed by nurserymen under such names as "sweet," "sour," "red-fleshed," and the like. In Calif., where this species is less commonly grown than in Fla., an oval yellow-fleshed form is called lemon guava, a pyriform white-fleshed one is known as pear guava, and a yellow one with pink flesh is called Hawaiian guava.

The name guayaba, by which the fruit is known in Spanish (the plant guayabo) is generally considered to have come from the island of Santo Domingo. Both Barbosa Rodrigues and Tavares, however, assert that it originated with the Tupi Indians in Brazil. In French the fruit is called goyave, the plant goyavier; in Portuguese goiaba, the plant goiabeira; and in German gujawa, the plant gujavabaum. The aboriginal name in Mexico is xacocotl, meaning sand-apple or sand-plum. Xocotl was the name applied by the Aztecs to all sour fruits, in contradistinction to zapotl which indicated all sweet ones.

Friedrichsthalianum, Niedenzu (*Calyptrapsidium Friedrichsthalianum*, Berg). COSTA RICAN GUAVA. CAS. Tree, 25-35 ft. high, with rather slender branches and smooth, dark brown bark; the young branchlets dark-colored, slightly pubescent; lvs. oval or oblong-oval, $1\frac{1}{2}$ -3 in. long, acuminate, the base acute, deep green, thickly chartaceous, smooth, almost glossy above, puberulent below, sparsely pellucid-punctate, midrib prominent below; peduncles axillary on the young branchlets, 1-fld.; petals 5, suborbicular; stigma peltate; ovary 5-locular: frs. globose, small, sour. Costa Rica, Guatemala, and probably other parts of Cent. Amer.—Of comparatively recent intro. into the U. S. It grows well in S. Fla., but seems too tender for most parts of S. Calif. It may succeed in protected locations. The frs. are considered especially valuable for jelly-making, because of their acidity. A plant which has been disseminated in this country under the name of *P. laurifolium*, intro. from Trinidad, appears to be this species.

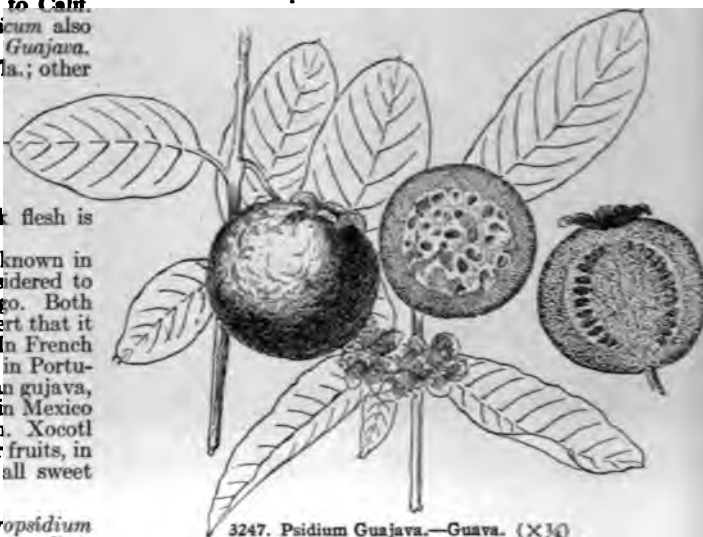
mölle, Bertol. GÜISARO. SOUR GÜISARO. GUAYABA ACIDA. Shrub or small tree, of rather slender growth, the young branchlets, peduncles, and lower surfaces of the lvs. reddish velvety; lvs. oblong-oval, 3-5 in. long, the apex obtuse, apiculate, base obtuse or shortly acute, rigidly chartaceous, light green, puberulent above; peduncles erect, 3-fld.; ovary 4-locular: fr. globose, about 1 in. thick, pale yellow when fully ripe, with whitish pulp containing many rather small seeds. The flavor is acid and not especially agreeable. S.

Mex. and Cent. Amer.—This species has been offered in Fla. for years but has never been extensively planted. It is fairly hardy, and has been grown in Calif. It fruits very prolifically, its season being late summer.

AA. Branchlets terete.

Araca, Raddi. BRAZILIAN GUAVA. ARAÇÁ DO CAMPO. Large shrub, the young branchlets hirsute: lvs. oblong-oval, large, obtuse, subvelutinous above, pubescent below, the veins reticulate, somewhat raised; peduncles axillary, 1-3-fld.: fr. ovoid or oblong, yellow, sweet only when fully ripe. Common on the dry uplands of Brazil.—The species disseminated in Calif. by Franceschi under the name of *P. Araca* does not agree with this description; it is a plant strongly resembling *P. Cattleianum* var. *lucidum*, but with broader and somewhat thicker lvs., the frs. usually larger, of a deep yellow color, with few seeds and a more prominent calyx.

Cattleianum, Sabine. STRAWBERRY GUAVA. Shrub or small tree, up to 20 ft. high, the bark smooth, green-



ish brown, the branchlets glabrous: lvs. obovate-elliptic, acute at apex and acute to cuneate at base, 2-3 in. long, glabrous, thick and coriaceous, dark green, almost glossy; peduncles axillary, 1-fld.; calyx-tube turbinate, 4- or 5-lobed, the lobes broadly oblong; petals obovate, thin; style slender, stigma peltate; ovary 4-locular: fr. obovate to roundish, 1-1 $\frac{1}{2}$ in. long, purplish red, with a thin skin and soft flesh, white toward the center, containing numerous hard seeds; flavor sweet and aromatic, sometimes likened to that of the strawberry, whence the common name. Brazil.—It flowers in late spring and ripens its fruits in Sept. and Oct. This species is extensively cult. in Calif., being harder than most others, and is also grown in Fla. Var. *lucidum*, Hort., the yellow strawberry guava, usually listed by the trade as *P. lucidum*, differs in the color of its fr., which is sulfur-yellow. It is thought to be somewhat more delicate in flavor, but is less commonly grown in both Fla. and Calif. than the type. Plants intro. under the names of *P. chinense* and *P. sinense* have proved to be nothing more than this variety.

A species intro. by Franceschi under the name of *P. acre*, Ten., resembles *P. Cattleianum* var. *lucidum*, but has more elongated and usually larger frs. The foliage is of the same type.—*P. dichotomum*, Weinm., is properly *P. Araca*; a species intro. by Franceschi as this species is evidently something else, having broad coriaceous, glabrous lvs. and somewhat resembling *P. Cattleianum* in habit.—*P. guajabita*, A. Rich., is a species recently intro. from W. Cuba, where it grows wild: the frs. are small and not considered very

valuable.—*P. guianense*, Pers., is a synonym of *P. fluviatile*, Rich., a species with branchlets terete, glabrous: lvs. oval, glabrous: pedicels opposite, 1-fld. Cayenne.—*P. guineense*, Swartz, is a synonym of *P. Araca*, Raddi, according to Berg, but DeCandolle considers it a distinct species. He distinguishes it from *P. Araca* by the lvs. less soft, glabrous above, with the nervation not raised as in the latter. More recently Urban uses it in preference to *P. Araca*, which latter is made a synonym; he states that it resembles *P. Guajava*, but is easily distinguished by the less numerous transverse veins, not impressed above. Swartz, in describing *P. guineense*, stated that it came from Afr., and was cult. in Santo Domingo, but as all psidiums are now known to be American, he was doubtless mistaken regarding its origin.—*P. littorale*, Raddi, intro. by Franceschi, resembles *P. Cattleianum* very closely, but has lvs. somewhat more attenuate toward the base, and obovate or pyriform frs. Berg (in *Linnaea*, xxvii) groups this species, *P. Cattleianum* and *P. humile* together under the name of *P. variable*. S. Brazil.—*P. montanum*, Swartz, is a species from the mountains of Jamaica, with 4-angled branchlets: lvs. oblong-oval, acuminate, glabrous: peduncles many-fld.: fr. subrotund.

F. W. POPEOE.

PSILOSTRÔPHE (Greek, *naked bud*, referring to the naked receptacle). Syn. *Riddellia*. *Compositæ*. Low and corymbosely branched woolly perennial herbs with alternate and spatulate or linear lvs., the cauline entire, and with small heads of yellow fls., the ligules large in proportion, pale or whitish in age and thin-papery: achenes narrow, terete, obscurely striate and angled. About 7 species, N. Amer. *P. tagetina*, Greene (*Riddellia tagetina*, Nutt.). Loosely or somewhat villously lanate, fairly widely branched: radical and even lower cauline lvs. often laciniate-pinnatifid: heads numerous, mostly cymosely clustered. W. Texas, E. Colo. and Ariz.—Intro. in botanic gardens abroad.

PSOPHOCÁRPUS (Greek, *noise* and *fruit*, referring to the fact that the pods when gathered and laid in the sun, blow up and explode with a noise). *Leguminosæ*. Tall twining herbs, with large tuberous roots, one of which is used as a vegetable in subtropical gardening: lvs. 3-foliolate, stipellate; stipules fastened above the base: fls. rather large, lilac; calyx with the 2 upper teeth connate; corolla much exerted, standard sub-orbiculate, wings obliquely obovate, keel obtuse, incurved; stamens monadelphous, the upper free downward; ovary stipitate: pod square, with a distinct wing to each angle.—About 5 species, Trop. Afr. and Asia.

tetragonolobus, DC. GOA BEAN. Root large, annual: sts. weak, wide-twining, glabrous: lfts. entire, ovate, acute, 3-6 x 2-6 in.: racemes lax, few-fld.; pedicels elongated: fls. large, light blue; calyx glabrous, lateral teeth oblong, lowest shorter and deltoid: pod 6-9 x 1 in., the wings $\frac{1}{8}$ - $\frac{1}{4}$ in. broad, usually much crisped and toothed. India.—Also grown in tropical and subtropical regions for the young tubers which are eaten raw or cooked, and for the young pods which are an excellent vegetable.

F. TRACY HUBBARD.

PSORALEA (Greek, *warty*; referring to the glandular dots which occur on the plants). *Leguminosæ*. SCURFY PEA. Herbs, shrubs, or subshrubs useful as border plants.

Usually copiously sprinkled with resinous black or pellucid dots and strongly scented: lvs. pinnate or trifoliate, rarely unifoliate; stipules free or adnate to the petiole: fls. in racemes or spikes, axillary or terminal, blue, purple, or white; calyx not enlarged after flowering, unequally 5-lobed; standard ovate or orbicular, clawed, wing oblong or falcate, keel incurved, obtuse, dark-colored; ovary sessile: pod ovoid, short, indehiscent, 1-seeded.—About 115 species common in the tropics and subtropics of both hemispheres, over 30 species in N. Amer. The genus comprises both greenhouse and hardy plants, some annual, others biennial, and still others perennial. The shrubby kinds are prop. by cuttings of half-ripened shoots, the herbaceous species by divisions when the new growth begins. The S. African species thrive in well-drained sandy peat, the others in ordinary garden soil.

A. Plants hardy in the N.

B. Number of lfts. 7.

subacaulis, Torr. & Gray. Perennial herb, stemless or nearly so, about 1 ft. high, with numerous, usually purple fls. in ovate or oblong, dense spikes: lfts. 7, digitate, obovate-oblong, 1 in. long: fl.-st. longer than lvs., rigid. April-June. Rocky hills, Tenn.

BB. Number of lfts. 3.

c. Lvs. digitately compound.

lanceolata, Pursh. Perennial herb, much branched, glabrous or nearly so, densely dark-glandular, 1-2 ft. high: lfts. sessile, bright green, entire, linear or oblanceolate: fls. bluish white, 3 lines long. June, July. Kans. to W. Canada west to Wash., etc. B.B. 2:281.

cc. Lvs. pinnately compound.

physodes, Douglas. Perennial herb, slender, 1-2 ft. high: lfts. ovate, about 1 in. long: fls. in short, close racemes; calyx $\frac{1}{4}$ in. long, becoming enlarged and inflated until nearly $\frac{1}{2}$ in. long; corolla $\frac{1}{4}$ in. long, white or purplish. Mountains of coast ranges, Calif.

BBB. Number of lfts. 5.

esculenta, Pursh. POMME BLANCHE. Hardy herbaceous perennial 4-18 in. high: lfts. 5 and digitate, short-stalked, oval or obovate, entire, obtuse, narrowed at base, 1-2 in. long: fls. bluish; spikes dense, $1\frac{1}{2}$ -3 in. long; root large, often clustered, starchy. June. Prairies, Man. and Dak. south. B.B. 2:284.—The following points, by Sprague, on the pomme blanche (also called prairie apple, prairie turnip, and Indian or Missouri bread-root) are taken from Goodale's Wild Flowers of America: "In the autumn the top of the plant dies and separates from the root, near the ground, and is blown about the prairies. After the top has gone the root cannot be readily found, and hence the Indians dig them in August for their winter use. The root lies deep in the ground and is about the size of a hen's egg. The outside is covered with a thick integument almost as tough as wood and of a dark brown color. The inside is whitish and not unlike a chestnut in appearance and taste, but not so sweet. The Indian women dig the roots with great facility by means of a pointed stick 2 or 3 feet long." The roots are spindle-shaped or turnip-shaped. If the Indians use them immediately, they generally roast them in ashes. They are also dried and stored for winter, and when wanted they are mashed between stones, mixed with water and baked into cakes over the coals. The root was frequently found in the canoes of the Indians by early travelers before the plant which produced it was known to white men. Nuttall wrote: "The taste is rather insipid, but not disagreeable either raw or boiled. Texture laminated, always tenacious, solid and never farinaceous." In 1846 the pomme blanche was proposed as a substitute for the potato. Its claims to consideration were discussed in several publications, with the result that it was thought to offer no possibilities of advance over the potato.

AA. Plants tender.

B. Number of lfts. 3.

c. Habit herbaceous.

bituminosa, Linn. Perennial herb, $1\frac{1}{2}$ -3 ft. high, appressed hirsute: lfts. nearly entire; lower ones ovate, obtuse; upper ones much narrower, acute: peduncles longer than lvs.; fl.-heads dense, involucrate, becoming elongated in fr.; fls. nearly 1 in. long. Spring and early summer. Poor soil, Arabia.

cc. Habit shrubby.

glandulosa, Linn. Petioles scabrous; lfts. 3, digitate, ovate-lanceolate, acuminate: fls. blue and white, in usually axillary racemes. Chile and Peru. B.M. 990.

BB. Number of lfts. 7-11.

pinnata, Linn. Arborescent or shrubby, 6-12 ft., densely branched and leafy: lfts. 7-11, pinnate, linear or lanceolate-linear, acute, commonly 10-15 lines long by about 1 line wide: fls. axillary, solitary or clustered, sessile or pedicelled, blue with white wings. S. Afr. G.C. III. 5:693; 33:301. J.H. III. 33:591. G.M. 46:611.



3248. *Psychotria undata*.
($\times \frac{1}{2}$)

affinis, Eckl. & Zeyh. (*P. pinnata* var. *subglabra*, Harv.). Shrub, to 10 ft., with 4-angled branches with resinous glands: lvs. odd-pinnate; lfts. opposite, 3-4-paired, linear, acute, dotted with black glands: fls. solitary, axillary, clustered at the ends of the branches; corolla blue with a dark purple keel-tip. S. Afr. B.M. 8331.—Only distinguished from *P. pinnata* by technical characters, principally the longer peduncles of *P. affinis*. Long grown in gardens under the name of *P. pinnata*.

F. W. BARCLAY.

F. TRACY HUBBARD.†

PSYCHOTRIA (Greek, *life-preserving*; referring to medicinal properties). Incl. *Grumilea* and *Gloneria*. *Rubiaceae*. Shrubs or small trees or rarely herbs, erect, climbing or twining, suitable for the warmhouse.

Leaves opposite, rarely whorled, with deciduous or persistent stipules: infl. terminal or rarely axillary corymbose cymes, or occasionally fascicled in the axils or capitate; fls. greenish white, yellow or rose; calyx short-tubed, limb rarely persisting; corolla-tube usually short or straight, elongate limb 5- or rarely 4- or 6-lobed; ovary 2-celled: fr. a berry or small drupe with 2 small hemispherical stones.—Over 500 species in the tropics and subtropics, frequent in Amer. Only occasionally cult.

A. Fls. yellow.

capensis, Vatke (*Grumilea capensis*, Sond.). An evergreen shrub or tree with shining lvs. 3-5 x $1\frac{1}{2}$ -2 in., and fls. in trichotomous, pedunculate corymbs: stipules coriaceous, broad: pedicels appressed, hairy, bracteated at the base; ultimate pedicel bearing a 6-12-fl. umbel; calyx $\frac{1}{2}$ line long; corolla 3 lines long, yellow: fr. black. S. Afr. B.M. 7916.—Cult. in S. Fla.

AA. Fls. white.

undata, Jacq. Fig. 3248. A glabrous shrub: lvs. papery, elliptical, costate-veiny; stipules large, connate,

sheathing half-way, obovate: panicle sessile, trichotomous, much exceeded by the lvs.; fls. clustered, white; corolla-lobes shorter than tube. Bahamas, Jamaica.

jasminiflora, Mast. (*Gloneria jasminiflora*, Lind. Andrè). Shrubby: bark whitish: lvs. 3 in. long, coraceous, pale beneath; nerves obscure: fls. white, 1-1 in. long. Brazil. G.C. II. 12:201. B.M. 6454. 34:275 (as *P. jasminoides*).—Offered in England.

F. TRACY HUBBARD.†

PTERÓXYLON (Greek, *sneeze-wood*, so called because the wood causes sneezing). *Meliaceae*. Sm. tree or shrub with bitter bark, whose wood has a commercial value.

Leaves odd-pinnate; lfts. unequal-sided, 5-8 paired, infl. axillary, paniced racemes crowded at the ends of the branches; fls. polyamous-dioecious, small, white or yellowish; sepals 4, short, obtuse; petals 4; disk hypogynous, glandular; stamens 4, alternate with the petals; ovary obcordate, 2-celled, ovules solitary: a compressed, 2-celled, 2-seeded capsule bi-lobed at the apex and cordate base.—One species in S. Afr. extending into Trop. Afr.

obliquum, Radlkf. (*P. utile*, Eckl. Zeyh.). **SNEEZEWOOD**. A tree 20-30 ft. high: lvs. opposite; lfts. ovate-oblong, obtuse, mucronulate: racemes shorter than the lvs.—Said to grow up to 50 ft. with a trunk 2-4 ft. diam. and a beautiful crown. The wood is extremely heavy and hard, strong and close-grained, very durable in contact with the ground and easily split. Among its uses are for piles of bridges and jetty fence-posts and recently for wood-engraving. It is said to turn readily even when green and to take a fine polish like mahogany. The seeds have short vitality.

F. TRACY HUBBARD.†

PTÉLEA (Greek name of the elm tree, transferred to this genus on account of the similarity of the fruit to *Rutaceae*). **HOP TREE**. Ornamental woody plants grown for their handsome foliage and also for their attractive light green fruit.

Deciduous shrubs or small trees: lvs. alternately



3249. *Ptelea trifoliata*, the hop tree, in fruit. ($\times \frac{1}{2}$)

extipulate, 3-5-foliate; lfts. entire or crenulate, punctate with pellucid dots; fls. small, polygamous, in terminal corymbs; lobes of the minute calyx, petals and stamens 4-5; ovary flattened, 2-celled, with short style; fr. a 2-seeded, indehiscent, small, flattened nut, furnished usually with a broad thin wing.—Usually 5 to 7 species distributed from Lake Ont. to Fla. and N.



Mex. are recognized, but recently about 60 species have been distinguished by Greene. Bark and foliage are sometimes used medicinally and emit (as well as the frs.) when bruised, a strong, pungent odor resembling somewhat that of the hop, for which the frs. are said to have been used as a substitute—hence the name hop tree.

The hop trees are ornamental shrubs or small round-headed trees with long-petioled leaves and greenish white flowers, followed by flattened usually broadly winged and nearly orbicular fruits. The one species chiefly cultivated is hardy North—if it proves tender, as it sometimes does, it is probably raised from southern seed—and is a small round-headed rather loosely branched tree with glossy green foliage, adorned in fall with numerous clusters of light green fruits which form a pleasing contrast with the dark green foliage and remain on the branches for some time after the leaves have fallen. It thrives best in a porous moderately moist soil and prefers a somewhat shaded position. Propagation is by seeds sown in fall; the varieties by layers or by grafting in spring under glass or budding in summer on seedlings of the type.

trifoliata, Linn. HOP TREE. WAFER ASH. Fig. 3249. Shrub or small round-headed tree, attaining 25 ft.: lfts. 3, sessile, ovate to elliptic-oblong, narrowed at both ends, sometimes acuminate, the lateral ones unequal at the base, crenulate or entire, dark green and lustrous above, pale below, glabrous or pubescent when young, 3-5 in. long; fls. $\frac{1}{3}$ - $\frac{1}{2}$ in. across; filaments villous below; fr. about 1 in. long, broadly winged. June. Ont. and N. Y. to Fla., west to Minn., and sometimes escaped from cult. elsewhere. S.S. 1:33, 34. G.C. III. 16:375. Several varieties are in cult., of which var. *aurea*, Behnisch (*P. aurea*, Hort.), the GOLDEN HOP TREE, with yellow foliage, is the best known. Var. *glauca*, Kirchn. Lvs. grayish green, pubescent when young. Var. *mollis*, Torr. & Gray (*P. mollis*, Curtis. *P. tomentosa*, Raf.).

Branchlets, infl., and lvs. beneath pubescent or tomentose. N. C. and Fla. to Ariz. More tender than the northern glabrous form and rarely cult.

aptera, Parry. Fig. 3250. Shrub, to 15 ft.: lfts. 3, sessile, the terminal one elliptic-obovate or obovate, $\frac{1}{5}$ - $\frac{1}{4}$ in. long, the lateral ones smaller, obscurely crenulate, pubescent; clusters few-fl.: fr. broadly ovate, turgid, wingless or nearly so, $\frac{1}{4}$ - $\frac{1}{2}$ in. long. Low. Calif. G.F. 3:333 (adapted in Fig. 3250).—Possibly cult. in Calif.; not hardy North.

ALFRED REHDER.

PTERIDIUM (Greek, with the form of *Pteris*). *Polypodiaceae*. Large ternately divided ferns commonly known as BRACKEN or BRAKES, with the sporangia borne on a marginal line-like receptacle as in *Pteris* (Fig. 3251) and covered with a marginal indusium, but with an additional membranous indusium within the receptacle. Commonly known as *Pteris*.

aquilinum, Kuhn. Lvs. scattered from an underground rhizome, 2-9 ft. high, ternately compound. Fields and waste places, in some of its forms throughout the world.—In some parts of the world it is used as food, in New Zeal. especially. It is counted a weed in the western states and a Farmers' Bulletin mentions methods of eradicating it. L. M. UNDERWOOD.

PTERIDOPHYLLUM (Greek, fern leaf, referring to the pinnate lvs.). *Papaveraceae*. Perennial acaulescent herbs with a rather thick præmorse rhizome: roots fibrous: lvs. all radical, petiolate, pectinate-pinnatifid: scapes naked, longer than the lvs. with a simple or at base subramose many-fl. raceme; sepals 2, deciduous, very short; petals 4, deciduous, elliptic-concave; stamens 4, deciduous; ovary orbicular, 1-celled, 2-4-seeded: fr. unknown. One species, Japan, *P. racemodsum*, Sieb. & Zucc. A small glabrous herb with narrowly obovate lvs. 4-6 in. long, about 1 in. broad: segms. oblong-linear, rounded at the apex: scape slender, 6-9 in. tall, bearing a loose raceme of small white fls. Intro. into botanic gardens abroad; probably not otherwise cult.



PTERIS (Greek name for a fern, from a word meaning wing; alluding to the prevalence of pinnate forms). *Polypodiaceae*. A large genus (60 species) of widely distributed ferns with sporangia borne on a marginal line-like receptacle that connects the free ends of the veins, and with the more or less altered margin of the leaf rolled over to form a continuous indusium. Many of the forms are among the commonest species of ferns in the trade and are very generally used for table decoration, especially as small plants for fern-dishes. For culture, see *Fern*.

The common brake, *P. aquilina*, Linn., is by some authors now referred to a separate genus; see *Pteridium*, above.

Pteris probably contains as many cultivated forms as *Nephrolepis*, but in America at least does not rank with this fern in importance in the trade. As pot-plants for the house, the species *cretica* and *serrulata* and their varieties will probably succeed as well as most of the *nephrolepis* forms, and better than some. They are, however, extremely uncommon, except as already noted, as small plants for fern-dishes. Apparently only one dealer in America makes a specialty of growing *pteris*. His list is given at the end of this article.

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A. Veins free throughout.

B. Lvs. simply pinnate, the lower pinnæ not divided.

1. *longifolia*, Linn. Lvs. 1-2 ft. long, 4-9 in. wide, lanceolate, often narrowed below; pinnæ 20-30 on each side, linear, entire. Tropical regions all around the world, extending to S. Fla. Var. *Mariesii*, Hort. Fronds shorter and pinnules straighter, the plant keeping closer to the pot; a good horticultural form.

BB. Lvs. simply pinnate, but the lower pinnæ forked.

2. *cretica*, Linn. Fig. 3252. Lvs. 6-12 in. long, on slender, straw-colored stalks, consisting of a terminal pinna and 2-6 opposite sessile pairs, the upper often decurrent, the lower pairs cleft nearly to the base into 2 or 3 pinnules. Quite generally distributed in tropical regions, extending to Cent. Fla. Many varieties are in cult., of which var. *albo-lineata*, Hort. (Fig. 3253), is one of the finest, with broader pinnæ and a broad, central, whitish band. Var. *major* and var. *nobilis* are larger horticultural forms, and var. *magnifica*, Hort., and var. *Mayii*, Hort. (*P. Mayii*) are still more developed. Var. *Wilsonii*, Hort., Fig. 3252, is one of the common garden forms.

3. *serrulata*, Linn. f. Lvs. 3-12 in. long, on slender brownish stalks, consisting of a terminal pinna and 5-6 pairs of lateral ones, the upper ones decurrent and the lower forked into 2 or 3 branches or with second branch above the basal one; pinnæ narrow, the indusium not

3252. *Pteris cretica* var. *Wilsonii*.

extending to the apices, which are sharply serrulate. China and Japan.—Many monstrous and distorted forms appear in cult., giving rise to such varietal horticultural names as *angustata*, *cristata*, *cristata nana compacta*, *cristata variegata*, *densa*, *Gilbertii*, *Ouvrardii* (*P. Ouvrardii*, Hort.), *voluta*, and the like, but these cannot be regarded as true varieties in any scientific sense.

4. *ensiformis*, Burm. Lvs. of two sorts, the sterile with elliptic or elliptic-lanceolate segms. the lower pinnæ 5-7-parted, the upper gradually simpler: sporophylls similar but taller and with longer and much narrower divisions. India to Polynesia; often confused with the preceding species, as both are more or less common in cult. Var. *Victoris* (*P. Victoris*, Hort.) is a garden variety with lvs. variegated with white.

BBB. Lvs. with lowest pinnæ pinnate.

5. *inæqualis*, Baker. Lf.-blades ovate-deltoid, 18-24 in. long, 10-15 in. wide, with 4-5 pairs of pinnate or pinnatifid pinnæ followed by 2-3 pairs of broadly linear simple ones and ending in a long, terminal, irregularly pinnatifid portion; divisions of the lower sides of the pinnæ uniformly much longer and larger than the upper ones. China and Japan.

6. *semipinnata*, Linn. Lvs. 12-18 in. long, the upper portion simply pinnate with decurrent pinnæ, the 4 or more lowest pinnatifid on the lower side, the upper side of the secondary rachises bordered by a narrow lamina. India, China, Japan, and E. Indies. Var. *Bausei*, Hort. (*P. Bausei*, Hort.), is a garden form.

BBBB. Lvs. with lowest pinnæ bipinnatifid.

c. Lowest pinnæ enlarged.

7. *quadriaurita*, Retz. Lvs. up to 2-3 ft. long, on strong, pale stalks, with a terminal pinna cut down to the rachis into numerous linear-oblong lobes, and below this several similar pinnæ on each side, the lowest of which are usually again compound with similar but smaller ones branching from the lower side at base. All tropical regions. Var. *argyræa*, Hort. (*P. argyræa*, Moore) is a form with a white band down the centers of the pinnæ. Var. *tricolor*, Hort. (*P. tricolor*, Lind.), is similar but has a tinge of red in addition.

8. *heterophylla*, Linn. Lvs. 6-8 in. long, on pale stalks, of two sorts; sterile lvs. elliptic, deeply incised; fertile lvs. narrowly linear-elliptic, with broad indusia and sterile apices ending in 2-3 teeth; both sorts bipinnate in the lower portions. W. Indies to Brazil. Sometimes referred to a distinct genus, *Anopteris*. Var. *internata* (*P. internata*, Moore) is a garden variety with smaller sporophylls and broader segms.

9. *tremula*, R. Br. Lf.-blades 2-4 ft. long, on polished chestnut-brown stalks; upper pinnæ simply pinnate, lower often much compound: sori copious, sometimes filling up the whole segm. except the rachis. Austral., New Zeal.—Many forms occur in cult., as var. *Smithiana* (*P. Smithii*, Hort.), *variegata*, and the like.

cc. Lowest pinnæ not enlarged.

10. *scaberula*, Richard. Lf.-blades 12-18 in. long, on brownish scabrous stalks, lanceolate-ovate in outline, tripinnate or quadri-pinnatifid throughout; rachis flexuous, scabrous; sori at maturity covering nearly the entire surface of the narrow lanceolate segms. New Zeal.

AA. Veins free, except for a single low arch next the midvein.

11. *biaurita*, Linn. (*P. mazima*, Baker. *P. nemoralis*, Willd.). Lf.-blades 15-30 in. long, with a terminal pinna 6-9 in. long, cut into narrow round-pointed divisions on 7-10 pairs of similar lateral ones, the lowest pair bearing a fork on the lower basal side. All tropical regions.—Habit very like *P. quadriaurita*, from which it differs chiefly in the venation. Var. *cristata* (*P. mazima* var. *cristata*, Hort.) is a cult. form.

12. *Wallichiana*, Agardh. Lf.-blades tripartite, with the lateral divisions again forked, the central one reaching 2 ft. long, with numerous lanceolate sessile opposite pinnules, cut again into numerous narrow lobes $\frac{1}{2}$ in. wide. India, Japan, and the Philippine Isls. Known also as *Campteria Wallichiana*.

AAA. Veins uniting, forming copious meshes.

13. *leptophylla*, Swartz. Lf.-blades triangular, 9-12 in. each way, on straw-colored stalks; upper pinna simple, those below pinnatifid to a winged rachis, the lowest similarly bipinnatifid at the base; veins fine: sori not reaching the tips of the segms. Brazil. Known also as *Litobrochia leptophylla*.



3253. *Pteris cretica* var. *albo-lineata*.—One of the standard house ferns.

Besides those already given, there are a number of forms the exact relationship of which has not been ascertained, and a few forms often listed under *Pteris* which belong properly under other generic names. These undetermined and transferable names mentioned in North America are: *P. adiantoides*, Hort.; *P. chinensis*, possibly a variety of *P. serrulata*; *P. geraniifolia*, see *Doryopteris*; *P. hastata*, see *Pellaea viridis*; *P. palmata*, see *Doryopteris*; *P. metallica*, Hort.; *P. Summersi*, Hort.; *P. plumosa*, Hort.; *P. regina*, Hort.

The following list contains forms of *Pteris* actually in the American trade. It represents the list of forms which are being or have been grown by H. A. Dreer, and is arranged in the order of the commercial importance of the varieties named. The writer is indebted to J. C. Clark, of Dreer's, for the information. It will be noted that there are several forms which have not already been described. The numerals are given for purposes of identification and they refer to the numbers of the species described in this article.

Wilsonii, 2.
cretica albo-lineata Alexander, 2.
cretica Ouwardi, 2.
Wimsettii Distinction, 2.
Wimsettii Dutrei, 2.
Wimsettii Gauthierii, 2.
Wimsettii grandis, 2.
Wimsettii tripartita, 2.
Wimsettii Sieboldii, 2.
Wimsettii rivertoniana, 2.
Wimsettii multiceps, 2.
Childsii, 2.
flabellata, 6.
Grevilleana variegata, Hort.
leptophylla argentea, 13.

Discarded varieties (by Dreer)
bisaurita.
nemoralis variegata, 11.
tricolor.
cretica Drinkwaterii, 2.
cretica Harrisonii, 2.
longifolia.
longifolia Mariesii.
metallica, Hort.
Summersii, Hort.
tremula Smithiana.
Wimsettii, 2.

P. Wilsonii, Hort. (Fig. 3252), represents about half the total sales. *P. Childsii* (G. 37:293) is an important form, but it produces no spores, and therefore can be reproduced only by division. *P. Wimsettii rivertoniana* is a new form intro. in 1915 which shows considerable promise. Numbers of other forms of *Pteris* may be expected to appear in the trade.

L. M. UNDERWOOD.
R. C. BENEDICT.†

PTEROCÁCTUS (*wingcactus*). *Cactaceæ*. Low cacti, with numerous slender round sts.: fr. a caps.; seeds flat, winged. Three species described, all from Argentina, little cult. *P. Kuntzei*, Schum. Roots several, tuber-like: branches glaucous: spines 9-12, minute, appressed: fls. yellow, terminal.

J. N. ROSE.

PTEROCÁRPUS (Greek, *wing fruit*; the pods are girded by a broad wing). *Leguminosæ*. Trees or woody climbers without prickles: lvs. alternate, uneven-pinnate; lfts. alternate or irregularly opposite, without stipules: fls. yellow, rarely mixed with violet and white, often showy, in axillary or terminal racemes; calyx turbinate; standard orbicular or broad-ovate, wings obliquely obovate or oblong, keel with its petals resembling or shorter than the wings, free or shortly connate; stamens all connate in a sheath slit above, or both above and below, or the upper one free; ovary sessile or stipitate: pod compressed, indehiscent, orbicular or broad-ovate.—About 45 species, natives of the tropics of both hemispheres. The following species may be in cult. in some greenhouses: *P. Draco*, Linn., growing 30 ft. high, native of Trop. Amer. *P. indicus*, Willd., "Burmese rosewood," growing about as high, but a native of the E. Indies. *P. Marsupium*, Roxbg., a pale yellow-fl. tree reaching a height of 40 ft. Coromandel. *P. Röhrrii*, Vahl, from Trop. Amer., which grows to be 20 ft. high.

PTEROCÁRYA (Greek, *pteron*, wing, and *karya*, nut; referring to the winged nuts). *Juglandaceæ*. Ornamental trees grown for their handsome pinnate foliage and the attractive pendulous racemes of winged fruits.

Deciduous: branches with lamellate pith; winter buds naked or scaly, more or less stalked and usually several in each axil, one above the other: lvs. alternate, exstipulate, odd-pinnate, with almost sessile lfts.: fls. monocious, in pendulous catkins, appearing with the lvs.; staminate catkins rather dense, fls. consisting of 3 connate bracts, 1-4 sepals and 6-18 stamens; pistillate catkins slender, the 1-celled ovary inclosed in a connate involucre elongated into a 4-toothed beak; stigmas 2: fr. a small 1-seeded, winged nut, 4-celled at the base. In germination the 4-lobed cotyledons are borne above the ground and become green, while in Juglans and Carya they remain inclosed in the nuts.—Eight species: 6 in China, 1 in Japan, and 1 in W. Asia.

The pterocaryas are handsome trees of rapid growth usually dividing into several stems from the base, with large pinnate leaves, rather inconspicuous flowers appearing with the foliage and adorned in summer and fall with long drooping racemes of winged fruits. They thrive best in rich and moist soil, but grow well also in drier localities. *P. fraxinifolia* and *P. rhoifolia* are hardy as far north as Massachusetts, but need some protection while young. *P. stenoptera* is more tender and the other Chinese species have not yet been sufficiently tried. Propagation is by seeds sown in autumn or stratified, also by layers and suckers.

A. Winter buds naked, usually several in each axil.

B. Fr. with 2 distinct wings.

C. Wings of fr. suborbicular: rachis of lf. terete, glabrous.

fraxinifolia, Spach (*P. caudata*, C. A. Mey. *P. Spachiana*, Lav.). Tree, to 60 ft., with spreading branches, often rising in several sts. from the ground: young branchlets slightly pubescent: lvs. 8-15 in. long, lfts. 11-25, ovate-oblong to oblong-lanceolate, acute or acuminate, serrate, pubescent only in the axils of the veins beneath, 2-4 in. long: stamens 10-16: fr. including the semi-orbicular wings, $\frac{1}{2}$ - $\frac{3}{4}$ in. broad, in racemes to 18 in. long. W. Asia. Gn. 34, p. 219; 62, p. 235. G.C. III. 4:381. G.W. 9, p. 10. L.I. 20, 21. Var. *dumosa*, Schneid. (*P. dumosa*, Lav.). More shrubby: lfts. smaller, about 2-2½ in. long. Seems more tender.

hupehensis, Skan. Tree, to 60 ft.: branchlets glabrous or sparingly hairy: lfts. 5-9, oblong to oblong-lanceolate, acuminate, rounded at the base, serrate, glabrous above, bearded in the axils of the veins beneath, 3-5 in. long: racemes to 18 in. long, glandular: fr. including the suborbicular wings 1-1½ in. across. Cent. China.

cc. *Wings oval to oblong-lanceolate, longer than broad: rachis more or less winged.*

Rehderiana, Schneid. (*P. fraxinifolia* × *P. stenoptera*). Fig. 3254. Tree, similar to *P. fraxinifolia*: rachis of lf. narrowly winged, the wings not serrulate and often wanting between the lower lfts.; lfts. 11-25, oblong to oblong-lanceolate, serrate, acute or acuminate, pubescent in the axils beneath, 2-4 in. long: frs. with oval or oval-oblong wings about ½ in. long. S.T.S. 2: 137.—Originated at the Arnold Arboretum and surpasses both parent species in vigor and hardness.

stenoptera, DC. (*P. sinensis*, Hort. *P. japonica*, Hort.). Tree, to 60 ft.: young branchlets villous: lvs. 6-12 in. long, with the rachis distinctly winged and



3254. *Pterocarya Rehderiana*. (×¼)

pubescent beneath; the wings often serrulate; lfts. 11-21, oblong, acute, serrate, pubescent beneath on the midrib, 2-4 in. long: stamens 6-10: fr. with oblong or oblong-lanceolate, usually upright wings diverging at a narrow angle. China. L.I. 19.

BB. *Frs. winged all around.*

Paliurus, Batal. Tree, to 60 ft.: branchlets pubescent while young: lfts. 7-9, oblong-ovate to oblong-lanceolate, acuminate, serrate, the midrib beneath and also the rachis pubescent, 3-6 in. long: racemes with pubescent rachis: fr. suborbicular or oval, winged all around, glabrous, 1½-2½ in. broad. Cent. China. J.H. S. 28, p. 65.

AA. *Winter buds covered with 2-3 dark brown, large scales, falling off early in spring: accessory buds wanting.*

rhoifolia, Sieb. & Zucc. (*P. sorbifolia*, Sieb. & Zucc. *P. laevigata*, Hort.). Tree, attaining 80 ft., with spreading branches: branchlets glabrous: lvs. 8-15 in. long, with terete pubescent or almost glabrous rachis; lfts. 11-21, oblong or oblong-lanceolate, acuminate, pubescent on the veins beneath or almost glabrous, 2-4 in.

long: fr. with a broad rhombic wing, about 1 in. across. Japan. S.Z. 2:150. S.I.F. 1:16.—This species is an important forest tree in Japan and has proved hardy at the Arnold Arboretum.

ALFRED REHDER.

PTEROCÉLTIS (Greek, *pteron*, wing; referring to the winged fr. and the close affinity of the tree to *Celtis*). *Ulmaceae*. A deciduous tree from N. W. and Cent. China, in foliage and habit very much like *Celtis*, but with a winged fr., resembling a small elm fr. Cult. and prop. like *Celtis*; probably hardy as far north as Mass. The only species is *P. Tatarinowii*, Maxim. Tree, to 50 ft.: branchlets glabrous: lvs. ovate to ovate-oblong, acuminate, broadly cuneate at the base, irregularly and sharply serrate, 3-nerved at the base, glabrous, 1½-3½ in. long: fr. axillary, solitary, slender-stalked, suborbicular, often broader than high and the wing usually emarginate at the apex.—Rare in cult. and without particular ornamental qualities.

ALFRED REHDER.

PTEROCÉPHALUS (Greek, *wing head*, so named because the head appears covered with a lot of feathers after the fls. fall off). *Dipsacaceae*. Herbs, half-shrubs and shrubs, annual or perennial: bracteoles narrow: involucre mouth short, ciliate, pubescent; calyx-limb 12-24 long bristles; corolla 5-fid; mostly without palea. About 20 species chiefly in the Medit. region but also in Asia. This genus was formerly included in *Scabiosa* but is now kept distinct. *P. Parnassii*, Spreng. (*Scabiosa Pterocéphala*, Linn.). A densely tufted perennial with woody sts. and branches, procumbent: lvs. narrowed into the stout petiole, ovate, obtuse, deeply crenate-toothed or lyrate-pinnatifid: heads depressed-hemispherical; fls. lilac-pink; corolla 2-lipped, upper 2-lobed, lobes short rounded; lower 3-lobed, lobes ovate, obtuse. Greece. B.M. 6526. Perfectly hardy in England, used for carpeting in the herbaceous border or suitable for rockwork.

PTERODISCUS (Greek, *wing* and *disk*, having reference to the wings of the disk of the fr.). *Pedaliaceae*. Perennial succulent herbs: st. tuberous at the base: lvs. opposite or alternate, coarsely dentate to pinnate-laciniate, rarely subentire: fls. solitary, short-pedicelled in the lf.-axils, yellow or purple; calyx small, 5-parted; corolla-tube funnel-shaped, oblique or slightly gibbous at base, limb somewhat 2-lipped, lobes subequal, orbicular; ovary 2-celled, cells undivided: fr. indehiscent, laterally compressed, with 4 longitudinal wings, unarmed. About 15 species in Trop. and S. Afr. *P. speciosus*, Hook. St.-base globose: st. densely glandular, 3-6 in. high: lvs. rather numerous, crowded in the upper part of st., linear to linear-oblong: calyx-segms. lanceolate, acuminate; corolla bright red-purple: fr. suborbicular, cordate at base. Trop. and S. Afr. B.M. 4117. G.Z. 21, p. 49. *P. luridus*, Hook. f., having dull yellow fls. and a native of S. Afr., is also occasionally cult. B.M. 5784.

PTEROLÒBIUM (Greek, *wing* and *pod*; the pods are produced into a wing at the extremity). *Leguminosae*. Woody climbers having the habit of *Cassalpinia*, from which they differ only in the pod: lvs. bipinnate; lfts. small, numerous; stipules small or inconspicuous: fls. small, white, racemose, the racemes in lax panicles at the tips of the branches; calyx deeply cleft, lobes imbricated; petals spreading, oblong and clawed; stamens 10, free, declinate; ovary sessile, 1-ovuled: pod indehiscent, with a large horny oblique wing. About 7 species in the tropics of the Old World. *P. indicum*, A. Rich. (*Cassalpinia lacerans*, Roxbg.). Branches slender, finely downy and with minute prickles: lvs. alternate with 8-16 pinnae, 12-16 lfts., pale green: racemes copiously panicked at the end of the branches; calyx with the lowest sepal longest; corolla yellow, not showy. Old World tropics.—Has been

intro. into England and is occasionally cult., the treatment being the same as that given *Cassalpinia*. The species varies in the size of the lvs. and in the width and size of the wing of the pod.

PTERONIA (Greek, *wing*, referring to the chaffy receptacle). *Compósitæ*. Small dry or glutinous shrubs: lvs. opposite or rarely alternate, mostly entire, glabrous or hairy, often ciliate: heads terminal, solitary or corymbose; involucre scales scarious, often shining; fls. yellow, rarely purple. About 60 species, natives of S. Afr. *P. incana*, DC., a scrubby divaricate branched bush with the twigs and lvs. thinly tomentose-canescens: lvs. opposite, sessile, linear-oblong, obtuse: heads sessile, 6-9 fld., golden yellow, involucre scales oblong, subobtuse, at first greenish yellow then fulvous and finally the centers brown: achenes top-shaped, densely and rigidly hairy. B.M. 8380.—Occasionally cult. abroad.

PTEROSPÉRMUM (Greek, *wing seed*; referring to the fact that the seeds are winged). *Sterculiáceæ*. Scaly or stellate-tomentose trees or shrubs, suitable for the warmhouse and outdoors in the southern part of the country.

Leaves 2-ranked, leathery, simple or lobed: infl. 1-3 axillary and terminal peduncles, 1- or few-fld.; fls. often elongated; calyx tubular, 5 more or less connate sepals; petals 5, deciduous with the calyx; staminal column short, bearing opposite the sepals 3 linear 2-celled anthers between each part of 5 anti-petalous ligulate staminoides; ovary inserted within the top of the staminal column: caps. woody or coriaceous, terete or 5-angled.—About 25 species, confined to Trop. Asia. *Pterospermums* are said to need considerable warmth, and perfect drainage is most essential. They grow best in a mixture of sandy, fibry loam and lumpy peat. Prop. by cuttings of half-ripened side shoots, cut close to the st.

acerifolium, Willd. Large tree: lvs. 10-14 x 6-12 in., roundish or oblong, often lobed, palmately 5-7-nerved; nerves prominent beneath: bractlets lacinate: fl.-buds oblong, obtuse, 5-angled, rusty tomentose: fls. 5-6 in. across, pure white, fragrant; sepals linear-oblong, thick; petals linear-oblong: caps. 4-6 in. long, 5-celled; seeds many; wing large, thin. B.M. 620. G.W. 7, p. 121.—Cult. in S. Calif.

F. TRACY HUBBARD.†

PTEROSTYLIS (Greek, *wing column*; the column is broadly winged). *Orchidiáceæ*. Terrestrial herbs with small underground tubers: radical lvs. ovate; st.-lvs. developed and linear or lanceolate, or reduced to scarious sheathing scales: fls. usually green, often tinged red or brown, large and solitary or smaller and several in a raceme; dorsal sepal broad, erect, incurved and very concave; petals lanceolate-falcate, attached to the basal projection of the column; labellum on a short claw at the end of the basal projection of the column, movable; column with a pair of hatchet-shaped or quadrangular wings.—About 50 species, mostly Australian but a few in New Zeal. and New Caledonia and 1 in New Guinea. *P. curta*, R. Br. Lvs. in a radical rosette, usually on long petioles, ovate or broadly elliptical, 5-9-nerved: scapes 1-fld.; usually about 6 in. high; galea erect, acute; lip linear, obtuse, entire, rather longer than the column; wings of the column with the lower lobe long and obtuse, the upper lobe short and broad. Austral. B.M. 3086. O. 1910:104. Cult. to some extent in greenhouses abroad as are the following: *P. acuminata*, R. Br. Austral. B.M. 3401; *P. Banksii*, R. Br. New Zeal. B.M. 3172; *P. Baptistii*, Fitzg. Austral. B.M. 6351; and *P. nutans*, R. Br. Austral. B.M. 3085. They are prop. by division and thrive in lf.-mold lightened by a little sand; the lower third of the pots should be filled with broken crocks.

F. TRACY HUBBARD.

PTEROSTYRAX (Greek, *pteron*, wing; alluding to the winged or ribbed fruit, by which it is distinguished from the allied genus *Styrax*). *Styracéæ*. Ornamental woody plants grown chiefly for their drooping panicles of white flowers.

Deciduous trees or shrubs, stellate-pubescent: lvs. alternate, denticulate: fls. in large panicles, terminal on short branchlets; calyx 5-toothed; corolla 5-parted almost to the base; stamens 10, somewhat longer than the corolla and slightly exceeded by the slender style; ovary 3-celled: fr. a ribbed or winged 1-2-seeded nut.—Three species in China and Japan. Sometimes united with *Halesia*, from which it is distinguished chiefly by the panicle drooping infl. and the 5-merous fls.

These are handsome trees or shrubs with rather large light green leaves and white flowers in showy pendulous panicles, followed by small rather inconspicuous fruits. They are only precariously hardy in sheltered positions as far north as Massachusetts. In June they are very attractive, with their graceful drooping panicles of numerous deutzia-like fragrant flowers. They thrive best in a moderately moist sandy loam and are propagated by seeds or layers and also by greenwood cuttings under glass.



3255. *Pterostyrax hispida*. (× 1/2)

hispida, Sieb. & Zucc. (*Halesia hispida*, Mast.). Fig. 3255. Tree, attaining 50 ft., with slender spreading branches forming an open head: lvs. short-petioled, ovate to oblong, narrowed at the base, acute or acuminate, denticulate, almost glabrous or pubescent on the veins beneath, light green above, grayish green beneath, 3-7 in. long: panicles 5-10 in. long; fls. creamy white, fragrant, about 1/2 in. long: fr. 10-ribbed, thickly covered with bristly hairs, 1/2 in. long. June. China, Japan. G.C. II. 22:177; III. 46:88; 48:125. Gn. 8, p. 243; 26, p. 23; 34, p. 111. R.H. 1875, p. 308. G.F. 5:389. M.D.G. 1899:353. G.W. 3, p. 37. F.E. 14:36 (pl. 21); 17:457. B.M. 8329. S.I.F. 2:65. G.M. 57:538.

corymbosa, Sieb. & Zucc. (*Halesia corymbosa*, Nichols.). Small tree or shrub: lvs. short-petioled, oval or ovate, abruptly acuminate, serrulate with usually bristly teeth, sparingly stellate-pubescent on both sides, 2 1/2-4 1/2 in. long: panicle corymbose, 3-5 in. long: fr. with 4-5 narrow wings, tomentulose, 1/2 in. long. June. China, Japan. S.Z. 1:47. S.I.F. 2:65.—Seems to be more tender than the preceding species and is but rarely cult.

ALFRED REHDER.

PTYCHOCOCCUS (Greek, *fold* and *grain*, probably referring to folds on the fruit). *Palmaceæ*. Separated from *Ptychosperma* by technical characters of the endocarp of the seed. Two species, New Guinea. *P. paradoxus*, Becc. (*Ptychosperma paradoxus*, Scheff.). St. simple, 9-12 ft. high, rather slender, covered with dense white arachnoid tomentum: lvs. at top of st. regularly pinnate-divided; segms. 6-15, in young plants sub-semi-rhomboid, later broad-lanceolate, contracted toward the base, tip oblique-truncate: fls. dioecious; ovary ovate-conical, 1-celled; seed 5-sulcate.

PTYCHORAPHIS (Greek, *folded* and *rape*). *Palmaceæ*. Malayan and Indian palms grown in warm greenhouses.

Stems slender, ringed: lvs. pinnate, the lfts. long-acuminate: spadix from between the lvs., much branched, the spirally arranged fls. usually staminate only toward the apex.—Three species, one from Singapore, 1 from the Philippines and 1 from Nicobar. The genus is placed next to *Rhopaloblaste* by Drude in Engler and Prantl's *Natürlichen Pflanzenfamilien* and distinguished by the ridge of the forked raphe and deeply ruminant seed, while the rumination of the upper parts of the seed is flattish. Cult. as for any tropical palm, requiring abundance of moisture.

augusta, Becc. Trunk becoming 80-100 ft. high in the wild, much lower in cult., slender, smooth: lvs. 6-10 ft. long; pinnæ 1-2 ft., linear, acuminate, bright green: spadix much branched, 2½-3 ft. long: fr. elliptical-oblong, red; seed grooved on one side. Nicobar. G.W. 2, p. 198.—Wm. Watson writes: "It is as graceful as *Cocos Weddelliana* or *Geonoma gracilis*, and it grows as freely under cult. as either of these popular palms." This rare palm has been offered in Amer., but is not known to be cult. at present.

Siebertiana, Hort. Sts. slender: lvs. copper-colored when young, afterward rich green; petioles colored with small brownish scales; lfts. 10 in. long, ¾ in. broad, tapering to a long thread-like point. Malaya. G.C. III. 43: suppl. Apr. 25. Gng. 16: 278. G.W. 13, p. 31.—An elegant species resembling a *kentia*. N. TAYLOR.†

PTYCHOSPÉRMA (Greek words, probably referring to the ruminant albumen of the seed). *Palmaceæ*. A small and unimportant group of palms little known in America.

Trunks smooth, ringed, crowned at the summit by a dense cluster of pinnately divided lvs.: lfts. acuminate, either entire or jagged at the apex: spadix simple or sometimes branched, appearing below the lvs.: fls. monœcious in the same spadix: fr. an ovoid drupe. For cult., see *Archontophoenix*, to which belong many of the plants in the trade under *Ptychosperma*. For *P. elegans*, consult *Seaforthia*.

Macarthurii, H. Wendl. Described as dwarf, and most cult. specimens are so; in nature 20-30 ft.: lvs. pinnate, the lfts. arching, from 3-9 in. long, usually obliquely cut at the apex: infl. unknown. Austral. G.Z. 23, p. 265.—Suckers freely from the base, thus making a bushy plant.

P. alba, Scheff. = *Dictyosperma alba*.—*P. Alexandræ*, F. Muell. = *Archontophoenix Alexandræ*.—*P. Cunninghamiana*, H. Wendl. = *Archontophoenix Cunninghamii*.—*P. elegans*, Hort. = *Seaforthia*.—*P. Rumphii* = *Drymophilus*.—*P. Seimurii* = *Balaka*.

N. TAYLOR.

PUCCOON: *Lithospermum*. P., Red: *Sanguinaria*. P., Yellow: *Hydrastis*.

PUERARIA (M. N. Puerari, botanist of Geneva). *Leguminosæ*. Twining herbs or shrubs, often climbing; grown for ornament.

Closely allied to *Dolichos* and *Phaseolus*, but differing among other things in the beardless style, tumid nodes of the racemes and monadelphous stamens: lvs. 3-foliate and stipellate, the lfts. sometimes lobed: fls. often large, pea-shaped, in long and dense, often

compound, racemes; standard usually spurred at the base, about equaling the wings and keel: pod flattish, linear, many-seeded.—Eleven species, Asian and Milanese.

A. *Lfts. not deeply lobed.*

B. *Pod not constricted.*

hirsuta, Schneid. (*P. Thunbergiana*, Benth. *Dolichos japonicus*, Hort. *Pachyrhizus Thunbergianus*, Sieb. & Zucc.). KUDZU VINE. Perennial, with large tuberous starchy roots, making a vigorous growth of slender, hairy, twining sts.: lfts. rhombic-ovate to nearly orbicular-ovate, variously lobed, but the margins entire and ciliate: fls. pea-shaped, purple, in axillary spikes late in the season, not showy: pod large and flat. Japan and China. A.G. 13: 387; 21: 505. G.F. 6: 505. R.H. 1891, p. 31. Gt. 45: 1429. Gn. 61, p. 161. G.W. 5: 605.—A hardy vine remarkable for the great rapidity of its growth, and most useful for covering arbors and verandas. It is also used as a forage plant. From a well-established root, vines will grow 40-60 ft. in a single season, producing a profusion of very large lvs. In the N. the plant dies to the ground in the winter, but in the S. the top becomes woody. The large fleshy root assumes most curious shapes, the main branches often being 4-5 ft. long. Georgeson writes of the plant in Japan: "The roots are fleshy and yield starch of excellent quality; the tough fiber of the inner bark is manufactured into a sort of cloth which combines fineness with remarkable strength; and in certain situations the vine is unparalleled for ornament and shade." The fls. are borne on the old or woody sts., but these sts. usually do not persist north of Philadelphia, and even rarely there. With age, the tops are more likely to survive the winter. Prop. by division of the roots, or by seeds when they can be had; also by cuttings.

BB. *Pod constricted.*

tuberosa, DC. (*Hedysarum tuberosum*, Roxbg.). Root tuberous, very large: st. shrubby: branches finely grayish pubescent: stipules minute, deciduous, ovate-cordate: lfts. membranous, roundish, 6-12 in. long, glabrescent above, below densely covered with a whitish appressed pubescence: fls. in slender, dense, often panicled racemes 6-9 in. long; pedicels very short, densely fascicled; calyx ½-¾ in. long, densely silky; teeth rather obtuse, shorter than the tube; corolla bluish, not twice as long as the calyx; limb of standard orbicular, distinctly spurred: pod 2-3 in. long, membranous, flat, 3-6-seeded, clothed with long, gray, silky bristly hairs. India. Wright, *Icones*, 412.—Intro. into U. S. in 1911. Suitable as an ornamental for the southern parts of the United States. The root contains a saccharine matter, an easily oxidizable resin; and a resin acid. It is also said to be used as a food and in medicine in India. When cut, the root exudes a bitter, acrid, opalescent gum.

AA. *Lfts. usually deeply lobed.*

phaseoloides, Benth. (*Dolichos phaseoloides*, Roxbg.). St. twining, often scarcely woody, clothed with dense spreading brown hairs: stipules small, lanceolate: lfts. membranous, sparingly covered with appressed bristly hairs above, gray and densely matted below; terminal lft. roundish, broadly ovate or rhomboidal, entire or shallowly or deeply lobed, 3-6 in. long: fls. clustered on numerous long-peduncled racemes; pedicels very short; bracts and bractlets lanceolate, strongly nerved, more or less persistent; calyx ¼-¾ in. long, densely clothed with appressed bristly hairs, lowest tooth lanceolate, as long as the tube, others shorter, all setaceous pointed; corolla reddish, twice as long as the calyx; standard roundish above, distinctly spurred: pod glabrescent, 3-4 in. long. India, China, Malaya.—Intro. into U. S. in 1911. Suitable as an ornamental in the southern states.

P. L. RICKER.

PULMONARIA (Latin, *lung*; the herb having been considered a remedy for diseases of the lungs). *Boraginaceæ*. **LUNGWORT**. Perennial herbs with a creeping rootstock, used in flower-gardens and hardy borders.

Leaves radical, often broad, cauline few and alternate: fls. in terminal cymes, rather large, blue or purple; calyx tubular-campanulate, 5-toothed or cleft to the middle only; corolla-tube straight, naked or pilose, limbs spreading, 5-lobed; stamens included in the tube: nuts smooth.—About 8–10 species in Eu. and 1 species said to extend into N. Asia. *Mertensia*, an allied genus, has a short open more deeply-cleft calyx, exserted, stamens, and slightly fleshy nuts.

Pulmonarias are of easy cultivation, preferring light soil, not very dry, in open or partially shaded positions. They are readily propagated by division. Divide the clumps every two or three years.

A. Lvs. white-spotted.

B. Plant very glandular.

saccharata, Mill. **BETHLEHEM SAGE**. Height 6–18 in.: st. setose-hairy, with articulate glands: radical lvs. oval-acuminate at both ends, slightly decurrent, larger than in following species: fls. whitish or reddish violet. April, May. In shady places, Eu. G. 29:147.

BB. Plant rough-hairy but slightly if at all glandular.

officinalis, Linn. (*P. maculata*, F. G. Dietr.). Height 6–12 in.: radical lvs. in distinct tufts, ovate-oblong to nearly linear, on long footstalks, coarsely hairy, more or less spotted: fls. in terminal forked cymes, red fading to violet. April. Woods, Eu. Gn. 74, p. 213.—Commonly cult.

AA. Lvs. entirely green.

B. Radical lvs. linear- or oblong-lanceolate, tapering to the petiole.

angustifolia, Linn. Height 6–12 in.: st. setose-hairy, having a few glands: radical lvs. linear-lanceolate to oblong-lanceolate, gradually tapering to and decurrent on petiole: fls. blue. April, May. Woods, Eu. Var. **azurea**, Hort., has been listed.

BB. Radical lvs. broadly elliptic-lanceolate, abruptly contracted into the petiole.

montana, Lej. (*P. mollis*, Wolff, not Auth.). Height 6–20 in.: lvs. bright green, radical broadly elliptic-lanceolate, abruptly contracted to the petiole: fls. violet. April. Cent. Eu.—Some of the material cult. as *P. mollis* and its varieties is probably not the *P. mollis* of Wolff and is referable to *P. officinalis*.

P. alba, Hort. Saul., is presumably *Mertensia sibirica* var. *alba*.—*P. avernensis*, Hort., with purple-blue fls. and compact growth, and its var. *alba*, Hort., with pure white fls., and good green lf., flowering in March, are listed.—*P. sibirica*. See *Mertensia sibirica*.—*P. virginica*. See *Mertensia virginica*.

F. W. BARCLAY.

F. TRACY HUBBARD.†

PULSATILLA: *Anemone*.

PULTENÆA (probably named after Dr. Richard Pulteney, 1730–1801). *Leguminosæ*. Shrubs suitable for the warmhouse, not commonly in cultivation, although many species have been occasionally grown.

Leaves alternate or rarely ternate-verticillate: fls. axillary and solitary or in terminal heads, usually yellow, orange or mixed with purple; ovary sessile or rarely short-stipitate: pods ovate, compressed or turgid, 2-valved.—About 90 species in Austral. *Pulteneas* grow best in a mixture of peat and silver sand and are said to need firm potting and careful watering with soft water. Prop. by seed or by cuttings made of the points of shoots when about three parts matured.

rösea, F. Muell. Erect heath-like shrub with virgate branches: lvs. linear-terete; stipules subulate-pointed: fls. pink, in terminal heads; calyx silky pubescent: pod acuminate. Austral. G.Z. 21:193.

PUMMELO (possibly contraction of Dutch *pompelmoes*). A generic term including most of the varieties of *Citrus grandis* (see page 782, Vol. II), other names for forms of this species being grapefruit (page 1391, Vol. III) and shaddock (Vol. VI).

The grapefruits long grown in the West Indies and the United States comprise a group of very juicy, subglobose (not pear-shaped) thin-skinned varieties differing widely from the common pummelos of the East Indies which are usually more or less pear-shaped, thick-skinned, and have a firm pulp. These latter are called shaddocks in the West Indies and United States. These two extremes are well separated in the character of the fruit and also show differences in the leaves and twigs, the pummelos having more or less hairy twigs, leaves downy on the under surface and very broadly winged petioles, while the grapefruits have nearly smooth, slender twigs, leaves smooth on the under surface, and narrower petioles.

In the Orient, however, there are a multitude of forms of pummelos, among which occur all the intermediates between the two extreme types noted above. Under these circumstances it seems advisable to retain the word pummelo in its usual East Indian sense, i. e., to include all varieties of *Citrus grandis* with the exception of the grapefruit group which is sufficiently distinct to merit a separate name. The attempt was made some years ago to apply the name pomelo to the grapefruit in this country but this name never attained any currency among growers, shippers, dealers, and consumers and was largely restricted to books and bulletins on descriptive horticulture. Pomelo is really a variant of pummelo, also written pummelow, pummeloe, pummalo, pumelo, pomello, and so on. In view of this confusing perplexity of similar names, it seems inadvisable to attempt to distinguish by the name pomelo the grapefruit of America from the pummelo of the East Indies.

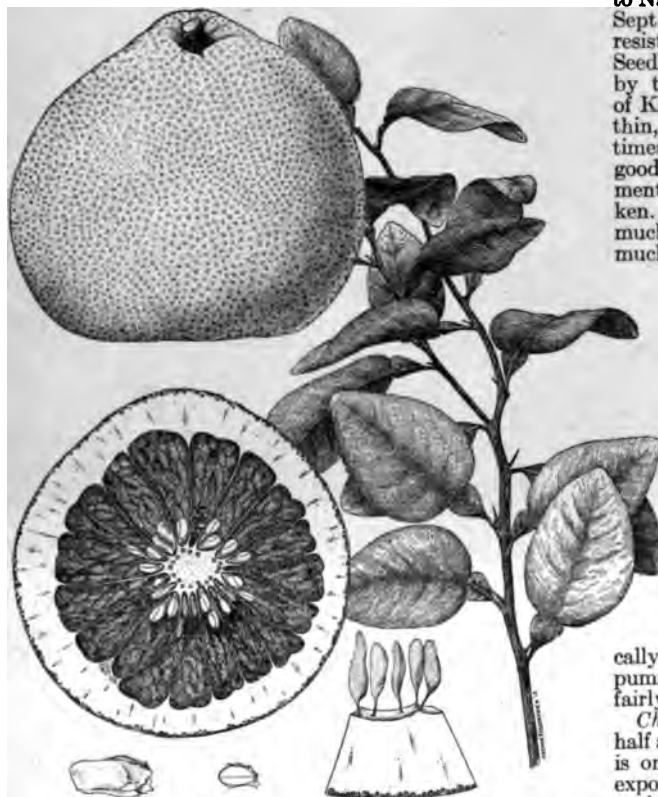
As a result of a trip to Japan, China, and the Philippine Islands made by the writer in 1915, it was found that some varieties of pummelos were very resistant to citrus canker (caused by *Pseudomonas citri*), unlike the grapefruit which is very susceptible to this disease. Unless citrus canker can be wholly eradicated from the southeastern United States it will be necessary to hybridize the grapefruit with the most canker-resistant sorts of citrus fruits in the hope of securing new varieties combining the juiciness and high flavor of the grapefruit with the canker-resistance of the other parent. In this work the canker-resistant varieties of the pummelo, some of them of excellent quality, promise to be of capital importance.

In view of this unforeseen importance of the pummelo, the following sketch of the more promising known varieties is given:

Malayan varieties.—**Banda navel**, from Plo-ay, Banda Islands, Malaysia. Fruits very large, nearly round but bumpy, growing in clusters of five or six; peel an inch thick; pulp white, juicier and sweeter than the common pummelo, nearly or quite seedless; the fruits sometimes show an included navel, a smaller fruit the size of a peeled orange being formed near the top of the larger fruit. Navel fruits are very rare in seedlings grown in Amboyna from seed brought from Banda. This very interesting variety described by Rumphius about 200 years ago does not seem to have been noticed since.—**Cassomba**. Rumphius describes this as a depressed globose variety as large as a man's head, commonly grown on the island of Amboyna. It has red vinous pulp as sweet as currants when ripe, often seedless.—**Labuan**, or **Bali** (?). A seedless pummelo of very superior quality is said to have been introduced by Sir Hugh Low from the island of Bali to Labuan Island off the coast of Borneo, from whence it was sent some fifteen years ago to the West Indies. The tree is said to be thornless.

Indian varieties.—*Bombay Red.* Fruit subglobose, 7 inches diameter; skin $\frac{1}{4}$ – $\frac{1}{2}$ inch thick; pulp very juicy, deep red (color of raw beef), pleasantly subacid, with a characteristic flavor. This is said by E. E. Bonavia to be "by far the finest variety of pummelo" he had seen. He describes a number of other sorts varying in shape, size, color, and juiciness. The leaves and twigs of some varieties are smooth; of others downy or hairy. In 1904 a collection of thirteen sorts of Indian pummelos was received by the Department of Agriculture from the Botanic Garden at Calcutta. A number of these have fruited both in California and Florida. One of these Indian pummelos (shown in Fig. 3256) was grown at Eustis, Florida, in 1915, and has pink flesh.

Siamese varieties.—The Siamese seedless pummelos, grown in the Nakon Chaisri district, have long been



3256. Pummelo. (Branch and fruit $\times \frac{1}{2}$; details $\times \frac{1}{2}$)

famous and have recently been studied there by H. H. Boyle (Phil. Ag. Rev. 7:65-9, pls. 3, 4, Feb., 1914. Journ. Heredity, 5:440-7, pls. 1-3, Oct., 1914). *Oval Nakon chaisri.* The best variety is slightly oval, $4\frac{1}{2}$ inches diameter, 4 inches high; skin pale yellow; flesh white, juicy, aromatic, not bitter; seeds few or none. Boyle considers this variety superior to any other pummelo and to any grapefruit and says it is a good fruit for market purposes.—*Flat Nakon chaisri.* A very flat fruit, $4\frac{1}{8}$ inches diameter, $3\frac{1}{4}$ inches high; skin bright yellow; flesh white, juicy, aromatic; seeds few or none. Boyle considers this an excellent fruit for market purposes. Two other seedless varieties, but of somewhat inferior quality, were found by Boyle.

Japanese varieties.—In Japan many varieties of pummelos, there called Buntan, Uchimurasaki or Jabon are known, variously estimated from 75 to 200. The following are among some of the more promising studied by T. Tanaka in the course of a survey of the citrus fruits

of Japan: *Hirado.* Large, depressed globose, about 4-5 inches in diameter and 3-4 inches high, with grapefruit-like smooth skin of lemon-yellow color; pulp juicy, rind thin, segments regular, core rather small, very good flavor; seeds small but numerous. This variety originated at Hirado near Nagasaki, Japan, some seventy-five years ago as a seedling of a pummelo brought from Java. The writer saw bearing trees of this variety at the Nagasaki agricultural experiment station in 1915 and found the fruits to be juicy and of excellent quality and noted that the tree remained almost entirely exempt from citrus canker (caused by *Pseudomonas citri*) which was attacking seriously Washington navel orange trees grown only a few yards distant. On account of its superior quality and high degree of canker-resistance, hybrids were made in June, 1915, between it and American grapefruit by means of pollen shipped from Florida to Nagasaki in vacuum tubes (Science N.S. 42:375-377. Sept., 1915). It is hoped to secure in this way canker-resistant hybrids equal to the grapefruit in quality. Seedlings of the Hirado pummelo are now being grown by the Department of Agriculture.—*Ogami,* vicinity of Kagoshima; rare; very large, very flat; rind smooth; thin, pinkish; core large, segments numerous, sometimes twenty-five, pulp pinkish, fine-grained, juicy, very good quality; seeds numerous.—*Hata-jirushi,* experiment farm of Count Tachibana, Yanagawa, Fukuoka-ken. A very large flat pummelo like the Ogami, very much like the latter in general characters but rind thicker and pulp vesicles coarser, good-flavored; seeds numerous.—*Yoko-jirushi,* experiment farm of Count Tachibana, Yanagawa, Fukuoka-ken. A large round variety with rough skin; oil-glands remarkably large and prominent, not much rag, segments regular, pulp slightly pinkish, good quality, vesicles long and parallel; seeds numerous.—*Take-jirushi,* experiment farm of Count Tachibana. Long-oval in shape, with salmon-colored flesh, segments large and rather irregular, very sweet and of good quality; seeds few.—*Tamura.* Shinkai-mura, Kōchi-ken; a round, smooth-skinned variety, with pale pink flesh, segments irregular, large, pulp coarse-grained and good quality; seeds very few.

Formosan varieties.—*Matō.* Matao, Ensuikōchō, Formosa. Common; fruit small, conical; rough-skinned, rind very thin; core small, pulp similar to the Ogami, very high quality; practically seedless; very early ripening. Besides the Matō pummelo, red (*To yu*) and white (*Pei yu*) pummelos of fairly good quality are commonly grown in Formosa.

Chinese varieties. *Canton varieties.*—There are at least half a dozen varieties grown about Canton. The Sung-ma is one of the best for export. The sorts commonly exported are pear-shaped, with a very fragrant thick peel and a very firm greenish yellow pulp of aromatic flavor. These pummelos are exported to all parts of the world where Cantonese Chinese live.—*Amoy,* a very large slightly pear-shaped pomelo with a thick skin and very firm white flesh, is produced near Amoy. In spite of its reputation it is of mediocre quality.

California seedlings.—There are many pummelo trees in northern California grown from seeds planted years ago by the Cantonese Chinese immigrants. Until a few years ago Canton pummelos were regularly imported by Chinese merchants in San Francisco. G. P. Rixford has located two score or more seedling trees in California which show considerable variation in the size, color, shape, and quality of the fruit. Some are of fairly good quality. These seedlings are mostly old bearing trees and furnish excellent opportunity for crossing with grapefruit in the hope of securing canker-resistant hybrids.

Florida shaddocks.—In Florida, pummelos have been grown for a long time under the West Indian name shaddock. The grapefruit is so much better, however,

that shaddocks have almost disappeared. H. H. Hume lists only two varieties, the *Mammoth*, oblate, 5-6 inches diameter, flesh firm, white, sweetish, bitter; and the *Pink*, oblate-pyriform, 6 x 6½ inches, flesh rough, pink, bitterish, subacid. Other forms are occasionally found but almost all are of very poor quality.

Hybrids.—Natural hybrids of the pummelo are common in Japan. They are mostly between the pummelo and the Mandarin types of oranges. Some are of great promise, however, being large, juicy, and very good-flavored. The common *Natsu mikan*, a very flat fruit 4-5 inches diameter, 2½-3 inches high, ripening very late in the season, is probably one of these hybrids. This group of hybrids is very similar to the tangelo, obtained by crossing the grapefruit with oranges of the Mandarin type. In India there seem to be natural hybrids between pummelos and lemons or citrons; possibly the group of citrus fruits called *Amilbed* by Bonavia is of this nature. After discovering that some varieties of pummelos are very resistant to citrus canker, the author inaugurated in 1915 in Japan a series of experiments in hybridizing the Florida grapefruit with different varieties of Japanese pummelos in the hope of securing canker-resistant grapefruit-like hybrids, as was noted above under *Hirado pummelo*.

Sour pummelos.—In India and other eastern countries very large acid-fleshed pummelos occur which are said to yield up to a quart of juice. One such sour pummelo grown near Eustis, Florida, has been used in breeding new types of acid fruits by hybridizing.

WALTER T. SWINGLE.

PUMPKIN AND SQUASH. Fruits, and the plants that produce them, of species of *Cucurbita*, used for food when cooked and also for stock-feed. See *Cucurbita*.

In North America, the word pumpkin (colloquially but incorrectly pronounced *punkin*) is applied to large late-maturing globular or oblong fruits of forms of *Cucurbita Pepo*, represented in the "field pumpkin" (Fig. 3257), from which pies are made and which is commonly fed to cattle and swine. The pumpkin is characterized by a five-angled stem which is not expanded where it joins the fruit (Fig. 1133, Vol. II), by rough vines and herbage, and by prominently lobed leaves. Sometimes the word is applied to some of the



3257. Connecticut or common field pumpkin.—*Cucurbita Pepo*.

earlier forms of this species, as to the Sugar pumpkins that ripen late in summer or early in autumn and are used for pies. It is also applied to forms of *Cucurbita moschata*, which, in the form known as Canada Crookneck squash, is sometimes called "pie pumpkin."

The word squash is adapted from an American Indian word, and is applied in an indefinite way to various members of the genus *Cucurbita*. The application of the name does not conform to the specific lines of the plants. What are called summer squashes

are mostly varieties of *Cucurbita Pepo*, of the Crookneck and Pattypan type. The winter squashes are either *C. maxima* or *C. moschata*, chiefly the former. If the name squash belongs to one species more than to another, this species is probably *C. maxima*. This species produces fruit with very firm or "solid" yellow flesh. The pictures on pages



3258. Winter or Canada Crookneck squash.—*Cucurbita moschata*.

909-911 in Vol. II, show some of the forms of these species. Fig. 3258 is the Winter or Canada Crookneck, one of the forms of *C. moschata*. Figs. 3259-3262 are forms of the multifarious *Cucurbita Pepo*. A further discussion

of the application of the vernacular names will be found in Vol. II, page 909.

Culturally, the pumpkins and squashes comprise one group of warm-season frost-sensitive plants. They are very easy to grow, provided they are given a warm and quick soil. They are long-season plants (except the "bush" varieties of summer squash), and therefore in the North they are very likely to be caught by frosts before the full crop has matured, unless the plants are started early and make a rapid and continuous growth. In hard rough clay lands the plants do not get a foothold early enough to allow them to mature the crop. On such lands it is impossible, also, to plant the seeds early. As a consequence, nearly all squashes are grown on soils of a loose and relatively light character. Sandy lands or sandy loams are preferred in the northern limits, but an open clay loam is probably the best soil in general for these plants. On very rich bottom lands the plants often thrive remarkably well, but there is danger that they may run too much to vine, particularly when the soil has too much available fertilizer. In order that the plants shall start quickly, it is necessary that the soil be in excellent tilth. It is customary, with many large growers, to apply a little commercial fertilizer to the hills to give the plants a start. A fertilizer somewhat strong in nitrogen may answer this purpose very well; but care must be taken not to use nitrogen too late in the season, else the plants will continue to grow over-vigorously rather than to set fruit.

Pumpkins and squashes are of two general kinds, so far as culture is involved, the bush varieties and the long-running varieties. The bush types are usually early. The vines run very little, or not at all. The various summer squashes belong to this category, and most of them are varieties of *Cucurbita Pepo*. The hills of bush varieties are usually planted as close together as 4 by 4 feet. On high-priced land they are often planted 3 by 4 feet. The fruits are borne close to the center of the plant. The long-running varieties comprise the autumn and winter types; and to this category may also be referred, for cultural purposes, the common field pumpkins. There is much difference between the varieties as to length of vine. On strong soils, some varieties will run 15 to 20 feet, and sometimes even more, producing the fruit some feet from the hill or the root. These varieties are planted from 8 to 12 feet apart each way. Sometimes they are planted in corn-fields, and they are allowed to occupy the ground after tillage for the corn is completed, but with the introduction of corn-harvesting machinery this practice is falling away.

For general field conditions, the seeds of pumpkins and squashes are usually planted in hills where the plants are to stand. If the land is mellow and rich, these hills are nothing more than a bit of ground 12 to 18

inches across, that has been freshly hoed or spaded and leveled off. On this hill, from six to ten seeds are dropped, and they are covered an inch or less in depth. In order to provide the seeds with moisture, the earth is usually firmed with the hoe. When the very best results are desired, particularly for the home-garden, hills may be prepared by digging out a bushel of soil and filling the place with rich earth and fine manure.



3259. Summer Crookneck squash.—*Cucurbita Pepo* form.

It is expected that not more than three to five of the plants will finally be left to each hill; but there are many contingencies to be considered. The young plants may be taken off by cutworms or by other insects, or they may be caught by frost, and it is well not to remove the extra plants too soon.

If it is necessary to start the crop in advance of the season, the seeds may be planted in pots or boxes in a forcing-house or hotbed about three weeks before it is time to set them in the field. If the seeds are started much earlier than this, the plants are likely to get too large and to become stunted. When set in the field, the roots should fill the pot or box so that the earth is held in a compact ball, and the plant should be fresh, green, and stocky. Sometimes the seeds are planted on sections of inverted tough sod, and the entire piece is transferred directly to the field. Plants that become stunted and develop one or two flowers when they are in the box are usually of little use. Sometimes seeds are planted directly in the field in forcing hills, and when the plants are established and the season is settled the protecting box is removed and the plants stand in their permanent positions.

A good vine should produce two or three first-class fruits; if, however, one flower sets very early in the season, the vine may devote most of its energies to the perfection of that single fruit and not set many others, or may set them too late to allow them to mature. If it is desired, therefore, that the plants shall produce more than one fruit, it is advisable to pick off the first fruit, providing it sets long in advance of the appearance of



3260. Summer Bergen squash, a form of *Cucurbita Pepo*.

other pistillate flowers. These remarks apply particularly to winter squashes in northern regions. With small varieties and under best conditions, as many as a half-dozen fruits may be secured from a single vine, and in some cases this number may be exceeded. Squash vines tend to root at the joints; but so far as general culture is concerned, this should be prevented, because it tends

to prolong the growing season of the vine, although it may have to be encouraged if the borer is prevalent. It is usually well, therefore, to lift the joints occasionally when hoeing, although the vine should not be moved or disturbed. This precaution applies particularly in the short-season climates of the North, where every effort must be made to cause the plant to set its fruit early in the season and to complete its growth before cool weather.

Tillage is simple. It consists in light working of the surface until the plants begin to run strongly, after which the big weeds are pulled by hand. For early results with bush squashes, or when the land is of a cold or backward type, the plants may be grown in hills that are raised a few inches above the general level; this adds to the expense, and in most cases it is better to practise level culture.

The varieties of pumpkins and squashes are numerous, and it is difficult to keep them pure if various kinds are grown together. However, the true squashes (*Cucurbita maxima*) do not hybridise with the true pumpkin species (*Cucurbita Pepo*). There need be no fear, therefore, of mixing between the Crookneck or Scallop squashes on the one side and the varieties of Hubbard or Marrow types on the other. The summer or bush squashes are of three general classes: the Crooknecks, the Scallop or Pattypan varieties, and the Pineapple or oblong-conical varieties, all forms of *C. Pepo*. The autumn and winter varieties may be thrown into



3261. The Pineapple Summer squash, one of the Scallop, Pattypan or Custard Marrow type.—*Cucurbita Pepo*.

several groups: the true field pumpkin, of which the Connecticut Field (Fig. 3257) is the leading representative, being the one that is commonly used for stock and for pies; the Canada Crookneck or Cushaw types, which are varieties of *C. moschata*; the Marrow and Marble-head types, which are the leading winter squashes and are varieties of the *C. maxima*; the Turban squashes, which have a "squash within a squash" and are also varieties of *C. maxima*. The mammoth pumpkins or squashes which are sometimes grown for exhibition and which may weigh 200 or 300 pounds, are forms of *C. maxima*.

In Europe the vegetable marrow type is much prized. It is a form of *Cucurbita Pepo*. In this country it is little grown, although it thrives well, the various summer squashes of the Crookneck and Scallop types being more popular. The following English advice on this vegetable is from a contribution to *Gardening Illustrated*, from which Fig. 3263, representing Moore's vegetable marrow, is also reduced: "Vegetable marrows should be eaten young—say when about one-fourth or one-sixth their full size. Cut in this state, and boiled quickly until quite tender in plenty of water, carefully strained, and served with melted butter, they are second to no vegetable that comes to table, not even excepting green peas or asparagus. Early cutting, careful cooking, and serving are the chief points to which attention should be paid; but there are others, one of the principal being rapid growth. Grow vegetable marrows quickly, and they are almost sure to be good; grow them slowly, and you will find them often tough and bitter. Hence the soil or place in which they are grown can hardly be too rich for them. Not but what they do fairly well in any

good garden soil, but the richer it is the better. On a rubbish-heap, for instance, vegetable marrows grow with wonderful vigor, and fruit abundantly." For early results, they are often started under glass in pots. There are many kinds or varieties. The custard marrows are fruits of the Scallop or Pattypan kind. The summer Crookneck is little used abroad for food.

Insect enemies and diseases of pumpkins and squashes are several. Perhaps the most serious is the striped cucumber beetle, which destroys the tender young plants. This insect is destroyed with the arsenicals applied in flour, also with tobacco powder and some other materials; but since it works on the under sides of the leaves as well as on the upper, it is difficult to make the application in such way as to afford a complete protection. The insects also are likely to appear in great numbers and to ruin the plants even whilst they are getting their fill of arsenic. If the beetles are abundant in the neighborhood, it is best to start a few plants very early and to plant them about the field in order to attract the early crop of beetles, thereby making it possible to destroy them. From these early plants the beetles may be hand-picked, or they may be killed with very heavy applications of arsenicals,—applications so strong that they may even injure the plants. Sometimes the hills of squashes are covered with wire gauze or mosquito netting that is held above the earth by means of hoops stuck into the ground. This affords a good protection from insects that arrive from the outside, providing the edges are thoroughly covered with earth so that the insects cannot crawl under; but if the insects should come through the ground beneath the covers they will destroy the plants, not being able to escape. The arsenicals should be applied when the dew is on, or the plants may be sprayed with bordeaux mixture to which the poison has been added. The squash bug or stink-bug may be handled in the same way as the striped cucumber beetle. This insect, however, remains throughout the season and, in many cases, it is necessary to resort to hand-picking. The insects crawl under chips or pieces of board at night, and this fact may be utilized in catching them. The young bugs can be killed by tobacco extract and soap, and by some of the emulsions.

The stem-borer attacks the vines later in the season, boring into the main stalk near the root, and causing the entire plant to lose vigor or to die. It is a soft white larva. As a safeguard, it is well to cover the vines at the joints with earth after they have begun to run, so that roots will form at these places and sustain the plant if the main stem is injured. The borers may also be cut out with a thin-bladed knife.

Tobacco dust is said to keep the insect away. Infected vines should be burned to destroy larvæ and eggs.

A wilt disease, caused by a species of bacillus, sometimes does damage to species of *Cucurbita*. The disease is likely to be associated with the punctures of the striped beetle. Burn the infected plants.

The summer squashes are eaten before the shell becomes hard, and not afterward. A thoroughly

mature Crookneck or Scallop is not used and not marketable. The late forms of *Cucurbita Pepo*, like the field pumpkin, are not long keepers, but the late squashes of the *C. maxima* type, as Hubbard, Boston Marrow, and Marblehead, can be kept till late spring. To keep these late squashes, care should be taken to have them full grown, with hard shells, not frosted or otherwise injured; they should be harvested

with the stem on, and much care should be exercised to prevent any bruising or rough handling. In a rather dry and somewhat dark cellar, with a temperature of about 40°, such fruits may be kept all winter. Commercial growers store them in above-ground houses built for the purpose, placed only one layer deep on racks or shelves. The house is well insulated to prevent fluctuation, kept dry, and provided with a stove or other heat for very cold weather, the temperature maintained at



3263. Vegetable marrow.—*Cucurbita Pepo*.

about 40° to 45° F. The following advice on the storing of squashes was written for the "Cyclopedia of American Horticulture" by W. W. Rawson: "Cut the squashes just before they are thoroughly ripe. Be careful not to start the stem in the squash. Lay them on the ground one deep and let them dry in the sun two or three days before bringing to the building. Handle very carefully when putting in, and be sure that the wagon in which they are carried has springs. Put them two deep on shelves in a building. This should be done on a cool, dry day. If the weather continues cool and dry, keep them well aired by day; but, if damp weather comes, build a small fire in the stove in order to dry out the green stems. Keep the temperature about 50°, and air well in dry weather. The squashes may need picking over about Christmas if put in the building about October 1; handle very carefully when picking over. Fifty tons can be kept in a single building with a small fire. Do not let them freeze, but if temperature goes down to 40° at times it will do no harm; nor should it be allowed to go as high as 70°. The Hubbard squash keeps best and longest and does not shrink in weight as much as other kinds; but any of them will shrink 20 per cent if kept until January 1." L. H. B.

PUNICA (*Punicus*, Carthaginian; hence *Malum punicum*, "apple of Carthage," an early name of the pomegranate). *Punicææ*. A small branched tree, the branches rather terete and spiny. The common pomegranate of cultivation.

Leaves opposite, subopposite and fascicled in short branches: fls. in simple axillary racemes, small, white; calyx persistent, 5-7-lobed; petals 5-7, lanceolate, corrugate; ovary inferior: berry spherical, thick-skinned, many-celled.—Two species, Orient to N. W. India. For cult., see *Pomegranææ*.

Granatum, Linn. **POMEGRANATE**. A large deciduous shrub or small tree, with oblong or obovate, obtuse, entire, glabrous and more or less shining lvs.: fls. orange-red, showy; calyx tubular, the short lobes persistent on the top of the fr. (as on an apple); petals inserted between the lobes; ovary imbedded in the calyx-tube (or receptacle-tube), comprising several locules or compartments in two series (one series above the other), ripening into a large, juicy, many-seeded pome-like berry. Persia to N. W. India. G.W. 10, p. 510.—A handsome plant, with showy fls. 1 in. across



3262. The Negro squash. One of the warty forms of *Cucurbita Pepo*.

in summer. Hardy as far north as Washington and Baltimore. It is also grown as a conservatory plant, blooming in winter as well as in summer. For ornament, the double-flowering kinds are the most popular (F.S. 18:1885, as *P. Granatum Legrellet*). There are many varieties. The treatment of the fruit-bearing varieties is discussed under *Pomegranate*. Var. *nana*, Hort. (*P. nana*, Linn.). DWARF POMEGRANATE. Seldom growing higher than a man, and usually treated as a pot-plant in the N. It is the best kind for greenhouse use. The double-fl. form is most common. B.M. 634. It is as hardy as the species, and is suitable for outdoor work where the climate is not too severe. On the Pacific Coast it is grown as a hedge-plant as far north as San Francisco. Both this and the species are easily grown by cuttings of dormant wood, as cuttings are, but the cuttings should be started indoors with some heat.

L. H. B.

PURSHIA (after F. T. Pursh, or Pursch, as is the original spelling of his name, 1774-1820; born at Grosse-hain, in Saxony; traveled in this country and wrote a flora of North America). Syn. *Künzia*. *Rosaceæ*. Low deciduous spreading shrub, allied to *Cercocarpus*, with alternate, mostly fascicled, small, cuneate and tridentate lvs.: fls. solitary, yellowish; calyx-tube tubular; petals spatulate, 5; stamens numerous; pistils 1 or sometimes 2: fr. a pubescent leathery achene exceeding the persistent calyx. Of little ornamental value with its sparse grayish or bluish green foliage and its rather inconspicuous fls. and frs., and but rarely cult. Probably hardy as far north as Mass., requiring sunny position and well-drained soil; an excess of moisture, especially during the winter, proves fatal to it. Prop. by seeds and probably by layers. The only species is *P. tridentata*, DC. (*Künzia tridentata*, Spreng.). Diffusely branched shrub, attaining 5, rarely 10 ft.: lvs. cuneate-obovate, 3-lobed at the apex, whitish pubescent beneath, $\frac{1}{4}$ - $\frac{3}{4}$ in. long; fls. solitary on short branchlets, almost sessile, yellowish, about $\frac{3}{4}$ in. across: fr. ovate-oblong, acuminate. April-July. Ore. to Wyo., New Mex. and Calif. B.R. 1446. Var. *glandulosa*, Jones (*P. glandulosa*, Curran), is glandular and has very small, almost glabrous lvs., sometimes pinnately 5-lobed.

ALFRED REHDER.

PURSLANE: *Portulaca oleracea*. P., Winter: *Montia perfoliata*.

PUSCHKINIA (named for Count M. Puschkin). *Liliaceæ*. Hardy or half-hardy bulbous plants which may be used in the rock-garden or border.

Leaves radical, few, the first often oblong, the others linear: infl. a simple leafless scape; fls. few, blue, loosely racemose; perianth campanulate, of 6 subequal lobes; stamens 6; ovary sessile, 3-celled: caps. membranaceous, dehiscent.—Two species, Asia Minor, the Caucasus and Afghanistan. These attractive spring-blooming bulbs have clusters of small 6-lobed white fls., each narrow lobe being prettily lined with blue. A good specimen may have as many as 10 fls., each $\frac{3}{4}$ in. across. The peculiar feature of the genus is the crown on which the stamens are borne. This is a white body of petal-like texture, having 6 lobes, each of which is variously toothed. The genus is allied to *Scilla* and *Chionodoxa*.

scilloides, Adams (*Adamsia scilloides*, Willd.). Height 4-12 in.: bulb globular, about $\frac{3}{4}$ in. thick: lvs. as long as scape, $\frac{1}{2}$ -1 in. wide: raceme 1-10-fl.; pedicels slender, erect; perianth usually bluish white; divisions elliptic-oblong, three times as long as the tube; crown one-third as long as divisions, cleft to middle into truncate or retuse teeth. April, May. Var. *libanotica*, Boiss. (*P. libanotica*, Zucc.), differs from the type in having divisions of perianth $\frac{1}{2}$ in. long and the teeth of the crown more acute and bifid. Gn. 32, p. 5; 54, p. 219. B.M. 2244. F.S. 21:2220 (as *P. sicula*).

F. TRACY HUBBARD.†

PUTRANJIVA (Indian name). *Euphorbiaceæ*. Evergreen trees, cult. for ornament in the tropics: lvs. alternate, simple: fls. small, axillary, single or in small clusters, apetalous; calyx imbricate; stamens 1-4; disk absent; styles broad, spreading; ovary 2-3-celled, 2 ovules in each cell: fr. a 2-celled drupe.—Two or more species in Trop. Asia. Related to *Drypetes*.

Róxburghii, Wall. INDIAN AMULET PLANT. WILD OLIVE. A moderate-sized tree, nearly glabrous: branches slender: lvs. short-petioled, ovate-lanceolate, serrulate, smooth, shining, 2-3 in. long; fls. yellow: fr. globose to ovoid, about $\frac{1}{2}$ in. thick, white-tomentose. India.

J. B. S. NORTON.

PUYA (Chilean name). *Bromeliaceæ*. Large terrestrial xerophytic South American bromeliads.

Allied to *Pitcairnia* (differing in having a fully superior rather than partially superior ovary).—Forty-four species, according to Mez (DC. Monogr. Phaner. 9). For culture, see also *Billbergia*. *Puya* also includes the plants known in trade as *Pourretia*.

Puyas and *pitcairnias* are generally found in collections of bromeliads and are usually grown in moist tropical houses. The native home of the *puyas* is on the steep stony slopes of the Cordilleras at high altitudes with little other vegetation for company except some species of cereus. This would indicate that drier and cooler conditions, or such as are given cacti and succulents, would suit them best, yet they thrive equally well in the tropical house. Indeed, the writer has found most of the family *Bromeliaceæ* very accommodating not only to temperature and moisture conditions, but to soils and methods of growing them; for example many of the *tillandsias* may be grown on blocks of wood as epiphytes, yet they do equally well grown in pots. But what perhaps is more remarkable is the fact that several of the stronger-growing bromeliads appear to grow equally well either in a strong loamy mixture, or a mixture of chopped fern root and charcoal. The writer has pineapples growing in both mixtures with equal success. But the most rational treatment is to give all the bromeliads conditions and soil similar to the environment in which they are found in their native habitat, yet according to the experience of the writer few plants possess such remarkable adaptability to changed conditions as do these plants. (E. J. Canning.)

A. Fls. yellow.

chilensis, Molina (*Pitcairnia coarctata*, Pers., and *P. chilensis*, Lodd.). Becoming 4-5 ft. or more high, sometimes branching: lvs. in tufts, 2-4 ft. long, very narrow, often recurved, the margins armed with strong recurved spines or thorns, glaucous: blossoms in a branching, hoary, bracted infl. rising 3-5 ft. from the top of the caudex, the fls. large (2 in. across), sessile or nearly so, the 3 lanceolate sepals greenish and the obovate-oblong much-exserted petals yellow or greenish yellow, the 6 erect stamens shorter than the petals, the stigma 3-branched. Chile. B.M. 4715. F.S. 9:869, 870. J.F. 4:392. J.H. III. 62:533. G.C. III. 7:685; 48:390; 54:3.—A striking and mammoth bromeliad, making a yucca-like mass of foliage and projecting above it a very showy infl.

AA. Fls. white or rose-color.

gigas, André. Still larger than the latter, sending its titanic spikes 20-30 ft. into the air, from a rosette of hard and thick spiny-toothed agave-like lvs.: infl. simple, dense, club-shaped, terminating the tall, erect, bracted scape: lvs. green above and white beneath, the spines black and hooked: fls. white, passing into rose. Colombia, 10,000 ft. R.H. 1881, p. 315, and Gn. 21, p. 309.—Can probably be handled like agaves.

AAA. Fls. blue.

cærulea, Lindl. (*Pitcairnia cærulea*, Benth. & Hook.). Foliage pineapple-like, with linear very acute

lvs. 2 ft. long, which are spinose-dentate and nearly glabrous; peduncle 3-4 ft. tall, the bracts membranaceous, the infl. somewhat branched but not loose: fls. narrow-tubular, the petals blue and oblong-obtuse, the sepals much shorter and green and obtuse; alternate stamens shorter. Chile. B.R. 26:11.

alpéstris, Poepp. (*Pitcairnia cærúlea*, Baker. *Puya Whitei*, Hook. f. *Pitcairnia alpéstris*, Bailey). Fl.-cluster much branched or paniced, with bracts more serrate than in *P. cærúlea*: fls. very large and showy, with a flaring mouth, dull metallic blue. Chile. B.M. 5732.—A plant in bloom has the habit of a yucca. This and *P. cærúlea* will probably stand considerable frost.

P. spathacea, Mes (Pitcairnia spathacea, Griseb.). Lvs. up to 18 in. long and 1 in. broad, the spines incurved; panicle about 2 ft. long; sepals ovate, acuminate, pale rose; petals dull blue. Argentina. B.M. 7966.—*P. violacea*, Mes. Lvs. up to 20 in. long, linear, stiff, spiny in margin; panicle 15-20 in. long; sepals green, lanceolate, 1-1½ in. long, acute; petals deep violet. Chile. B.M. 8194.

L. H. B.

GEORGE V. NASH.†

PYCNANTHEMUM (Greek, *dense* and *blossom*; referring to compact flower-heads). *Labiata*. MOUNTAIN MINT. BASIL. Hardy aromatic perennial herbs suitable for the flower-garden.

Stems corymbosely branched above: lvs. entire, glabrous or pubescent, nearly sessile: infl. dense, many-fld. whorls, crowded with bracts and usually forming terminal heads or close cymes; fls. whitish or purplish, late summer and early autumn; calyx about 13-nerved, naked in the throat; corolla short, more or less 2-lipped; stamens 4, lower pair rather longer than the upper, which are sometimes abortive.—About 18 species, N. Amer. The oldest generic name of this is *Koellia*, which is used by many, but *Pycnanthemum* is maintained in the list of "nomina conservanda" as accepted by the Vienna Congress. The genus differs from *Monarda* in having smaller and canescent fl.-heads. *Pycnanthemum*s are mint-like plants of easy cult. in any good soil. The following grow 1-3 ft. high, and bear fl.-heads ½ in. across or less.

A. Lvs. lanceolate or linear-lanceolate: calyx-teeth *oxae-triangular*.

virginianum, Dur. & Jacks. (*P. lanceolatum*, Pursh). St. rather stout: lvs. fragrant, firm, acuminate at apex, rounded or narrowed at base, 1-2 in. long, 2-5 lines wide. Dry fields, Canada to Ga., west to Minn. B.B. 3:112.

AA. Lvs. linear: calyx-teeth *subulate*, bristle-tipped.

flexuosum, BSP. (*P. linifolium*, Pursh). St. slender: lvs. 1-2 in. long, ½-1½ lines wide. In fields, Mass. to Fla., Ont., Minn., and Texas. B.B. 3:111.

P. Monardella, Michx., is properly *Monarda clinopodia*, Linn. A perennial herb with slender, usually simple st. 1-3 ft. high: lvs. lanceolate to ovate, membranaceous, bright green, slender-petioled, 2-4 in. long; fl.-heads solitary, terminal; corolla yellowish, 1 in. long or less. June-Aug. Fields, Ont. to Ga. B.B. 3:102.

F. W. BARCLAY.

F. TRACY HUBBARD.†

PYCNOSTACHYS (Greek, *thick spike*, referring to the heavy spikes of fls.). *Labiata*. Erect perennial herbs: lvs. opposite, broad or narrow, sessile or petioled: whorls condensed into a dense terminal spike; fls. bright blue or violet; calyx slightly accrescent, 5-toothed; corolla-tube longer than the calyx, upper lip short, 4-toothed, lower longer, deeply concave; stamens 4: nutlets subglobose, smooth.—About 40 species, natives of Trop. and S. Afr., 1 in Madagascar. *P. urticifolia*, Hook. A much-branched perennial herb, 5-7 ft. high: lvs. ovate-acute, deeply cut, crenate, densely pubescent: spikes very dense, 2-3 in. long; corolla bright blue. Trop. and S. Afr. B.M. 5365. More or less frequent in gardens in England. *P. Davei*, N.E. Br. A stout herb, 4-6 ft. high and loosely branched pyramidal habit: lvs. narrowly lanceolate, acuminate, serrate: fls. many, crowded, in short spikes

terminating all the branches, cobalt-blue; calyx-teeth needle-like. Trop. Afr. Intro. into England. B.M. 8450. *P. cærúlea*, Hook., with 4-sided st. about 1 ft. high, bright blue fls. and sessile oblong or linear-lanceolate lvs., a native of Madagascar, has also been cult. in England.

PYRACANTHA (Greek, *pyr*, fire, and *akanthos*, thorn; alluding to the bright red fruits). *Rosaceæ*. FIRETHORN. Ornamental shrubs, grown chiefly for their bright red berry-like fruits and also for their white flowers and firm foliage.

Thorny half-evergreen shrubs: lvs. alternate, short-petioled, narrow, crenulate or sometimes entire, stipulate: fls. in corymbs; sepals short, petals suborbicular, spreading; stamens 20, with yellow anthers; carpels 5, free on their ventral side, on their dorsal side connate with the calyx-tube about half or less: fr. a small pome with persistent calyx, red or orange, with 5 stones.—

Three species, from S. E. Eu. to Cent. China and the Himalayas. The genus is closely allied to *Cotoneaster* but is easily distinguished by the crenulate lvs. and the thorny branches, also by the more conspicuous stipules. From *Crataegus* it is chiefly distinguished by the



3264. *Pyracantha coccinea*. (× ¼)

structure of the ovary, which contains 2 equal ovules in each cell, while in *Crataegus* each cell contains only 1 fertile ovule and a second imperfect and smaller one.

The pyracanthas are usually small shrubs with rather small and narrow leaves and with white flowers in small corymbs followed by bright red or orange fruits. *P. coccinea* is hardy as far north as Massachusetts in sheltered positions. It is a handsome low evergreen shrub, especially when loaded with its bright red fruits, these remaining on the branches all winter if not eaten by birds, which are fond of them; it is also pretty in spring with its numerous corymbs of white flowers. It is well adapted for planting on rocky slopes or sunny rockeries or for borders of shrubberies; it may also be used for low ornamental hedges or for covering walls, as it stands pruning well and is easily trained into any desired shape. It thrives in almost any kind of well-drained soil, including limestone, and prefers sunny positions. Propagation by seeds or by cuttings of ripened wood in fall under glass, kept during the winter in a temperate greenhouse; also by layers and sometimes by grafting on hawthorn or cotoneaster.

A. Lvs. beneath and calyx glabrous.

coccinea, Roem. (*Cotoneaster Pyracantha*, Spach. *Crataegus Pyracantha*, Borkh. *Mespilus Pyracantha*, Linn.). FIRETHORN. FIERY THORN. EVERLASTING THORN. Fig. 3264. Shrub, attaining 6 ft., rarely 20 ft., with numerous short spines: young branchlets and petioles grayish pubescent: lvs. oval-oblong to oblanceolate, acute, crenate, glabrous or slightly pubescent when young, ¾-1½ in. long; corymbs pubescent, many-fld., about 1½ in. broad; fls. small, white: fr. numerous, bright red, about ½ in. across. May, June. Italy to W. Asia. Gn. 33, p. 464. Var. *Lalandii*, Dipp. (*Cotoneaster crenulata*, Hort., not Wenzig), is of more vigorous growth, with slender branches: lvs. less deeply crenate: corymbs larger: fr. bright orange-red. Well suited for covering walls and said to be hardier than

the type. M.D.G. 1901:136. Var. *pauciflora*, Dipp. Of low, dense habit and very thorny: corymbs small: fr. yellowish red. Hardy, and well suited for hedges. Var. *leucocarpa*, Hort. (*Cotonedaster Pyracantha leucocarpa*, Hort., var. *fructo-albo*, Hort.), is a form with white or yellowish frs.

crenulata, Roem. (*Cotonedaster crenulata*, Wenzig. *Cratægus crenulata*, Roxbg. *P. Rogersiana*, Hort.). Closely allied to the preceding: branchlets and petioles rusty-pubescent, glabrous at length: lvs. narrower, oblong to oblanceolate, obtuse or acutish, more leathery, bright green and glossy above, 1-2 in. long: corymbs glabrous: fr. slender-pedicelled, globose, bright orange-red. May, June. Himalayas. B.R. 30:52. R.H. 1913: 204 and p. 205. G.M. 58:31. G.C. III. 57, suppl. Feb. 20.—More tender than the preceding, with handsomer, glossier foliage. Var. *yunnanensis*, Vilm. More vigorous: spines to 2 in. long: lvs. 2-3 in. long, finely denticulate, obtuse: corymbs more numerous, many-flid.: fr. short-pedicelled, bright coral-red, smaller. Yunnan. R.H. 1913:204.

AA. Lvs. beneath and calyx tomentose.

angustifolia, Schneid. (*Cotonedaster angustifolia*, Franch.). Shrub with long and slender, spreading and often partly prostrate branches; young branchlets yellowish tomentose: lvs. subcoriaceous, narrow-oblong, obtuse and mucronulate, recurved at the margin, entire or sparingly glandular-serrulate, glabrous, grayish tomentose beneath, $\frac{3}{4}$ -2 $\frac{1}{4}$ in. long: corymbs few-flid., short-stalked; calyx grayish pubescent outside: fr. depressed-globose, $\frac{1}{2}$ in. thick, orange-yellow. May, June. S. W. China. B.M. 8345. G.C. III. 36:441. Gn. 67:105, p. 24.

ALFRED REHDER.

PYRENACANTHA (Greek, *grain, thorn*; the inner surface of the husk of the fruit is covered with many blunt prickles). *Iaciniaceæ*. Climbing shrubs with alternate, hairy, 3-5-nerved, entire, or toothed or lobed lvs. and fls. in spikes: fls. dioecious; perianth 4- or rarely 3-5-lobed; ovary superior, 1-celled, 2-ovuled: drupe compressed, with the mesocarp spinulose-verrucose within. About 15 species from Trop. and S. Afr. *P. malvifolia*, Engl. A succulent plant with a fleshy subglobose smooth st. resembling a stone from a distance: branches short or long and scandent: lvs. kidney-shaped, irregularly 3-5-lobed, pilose: fls. small, in spikes; perianth 4-lobed. E. Afr. G.W. 10, p. 354.

PYRÆTHRUM (a name used from the time of Dioscorides, the derivation from the Greek, *much fire*, referring to the acrid roots). *Compositæ*. This name is still commonly used in garden literature and language although the genus has long been reduced to a section of *Chrysanthemum*. Almost every nursery catalogue offers *P. roseum* and its numerous varieties, which is referred by botanists to *Chrysanthemum coccineum*; also *P. partheniifolium* var. *aureum*, the golden feather, and *P. uliginosum*. (See Vol. II, p. 753.) All three of these are rather common in gardens and they are known to most lovers of hardy perennials.

More recent introductions under the name *Pyrethrum* are *P. Tchihatchewii*, also spelled *Tchihatcheffii*, the "turfing daisy" (see *Chrysanthemum Tchihatchewii*, Vol. II, p. 756), and *P. leucopiloides*, Hausskn., a sub-alpine perennial with silvery white leaves and large yellow flower-heads. Asia Minor. Suitable for the rockery. This last species is not mentioned under *Chrysanthemum*.

PÝROLA (a diminutive of *Pyrus*, the pear tree, from some fancied resemblance in the foliage). *Pyrolacææ*. WINTERGREEN. SHIN LEAF. Low and smooth perennial herbs with running subterranean shoots; suitable for the native garden though not commonly cultivated.

Acaulescent or caulescent, with a cluster of roundish

or elliptical evergreen basal lvs. and a simple raceme of nodding white, greenish or purplish fls. on an upright more or less scaly-bracted scape: calyx 5-parted, persistent; petals 5, concave, deciduous; stamens 10: caps. depressed-globose, 5-lobed, 5-valved.—Ten to 15 species, Great Britain to N. Asia and N. Amer. south to Mex. Formerly referred to *Ericacææ*, but now placed in *Pyrolacææ* together with *Chimaphila* and *Moneses*. The name wintergreen is usually applied to *Gaultheria*.

Pyrolas grow naturally in rather poor sandy uplands and in bogs. Like many members of the heath family, wintergreens are difficult to cultivate and will not succeed in garden soil. In removing them from the woods, care should be taken to secure a large ball of earth. They may then succeed in the shade of evergreens and upon rockeries in peaty soil. The species are scarcely in general cult.; they are offered by dealers in native plants. *P. americana* is probably more cultivated than the others.

A. Fls. greenish; style straight.

secunda, Linn. Height about 6 in.: subcaulescent: lvs. thin, ovate, crenate, 1-1 $\frac{1}{2}$ in. long: fls. small, in a 1-sided, dense, spike-like raceme. N. Atlantic States to Lab., Rocky Mts. to arctic regions, N. Eu. to Japan. June-Aug.

AA. Fls. greenish white; style curved downward.

chlorantha, Swartz. Height 5-10 in.: lvs. small, orbicular, thick, dull, shorter than the petiole: fls. few; anther-cells with beaked tips. Lab. to Pa., Rocky Mts., north to subarctic regions. June and July.

elliptica, Nutt. Height 8-10 in.: lvs. broadly oval or oblong, thin, dull, serrulate, 2-2 $\frac{1}{2}$ in. long, longer than the petiole: loosely 5-10-flid.; calyx-lobes ovate, acute, one-fourth length of the obovate whitish petals. Canada to Brit. Col. and through N. Atlantic States to New Mex., Japan. June and July.

picta, Smith. Height 5-10 in.: lvs. thick, broadly ovate to spatulate, dull, blotched with white above, pale or purplish beneath, longer than the petioles: calyx-lobes ovate, not one-half length of the greenish white petals. Pacific slope.

AAA. Fls. white.

americana, Sweet (*P. rotundifolia*, Amer. Auth., not Linn.). Height 5-12 in.: lvs. orbicular, about 2 in. long, thick, shining above, shorter than the petioles: fls. numerous; bracts conspicuous; calyx-lobes lanceolate or oblong-lanceolate, one-third to one-half length of the thick white petals. E. Canada, south to Ga., west to S. D. June-Aug.

AAAA. Fls. pink or purple.

asarifolia, Michx. Lvs. transversely broad-elliptic or round-reniform, cordate: fls. $\frac{3}{4}$ - $\frac{5}{8}$ in. across, purple; calyx-lobes ovate to ovate-triangular. Que. to Yukon, south to Nova Scotia, N. New England, W. N. Y., N. Mich., and Col.; also in Asia. June-Aug.

Var. *incarnata*, Fern. (*P. rotundifolia* var. *uliginosa*, Gray), with pink or rose-colored fls. and subcordate to obovate, dull lvs., occurs in swamps, arctic regions, south to N. New England, Cent. N. Y., Mich., Wis., Col., and Calif.; also Asia. F. TRACY HUBBARD.†

PYROLÍRION: *Zephyranthes*.

PYROSTEGIA (Greek, *pyr*, fire, and *stega*, roof; alluding to the color of the flowers and the shape of its upper lip). *Bignoniaceæ*. Ornamental vines cultivated chiefly for their handsome and showy flowers.

Evergreen shrubs climbing by tendrils: lvs. 2- or 3-foliate; tendril filiform, 3-parted: fls. in terminal panicles; calyx campanulate or nearly tubular, truncate or dentate; corolla tubular-funnelform, curved, the lobes valvate in bud; stamens exceeding the tube; disk annu-

lar or slightly cupulate; ovary linear with the seeds arranged in 2 rows or in zigzag; pod linear with leathery valves and elliptic winged seeds.—Four species in S. Amer. Formerly usually united with *Bignonia*, but easily distinguished by the lobes of the corolla being valvate in bud and by its tubular, nearly claviform shape. Cult. and prop. like *bignonia*.

venusta, Baill. (*P. ignea*, Presl. *Bignonia venusta*, Ker). Fig. 3265. Sts. striate or somewhat angled, pubescent while young; lfts. usually 3, ovate to ovate-oblong, shortly and obtusely acuminate, cuneate at the base, glabrous above, puberulous beneath, $1\frac{1}{4}$ – $2\frac{1}{4}$ in. long; fls. in drooping panicles; calyx campanulate, shortly 5-toothed; corolla tubular-funnelform, crimson-orange, 2–3 in. long, with oblong, obtuse, reflexing lobes. Brazil. B.M. 2050. P.M. 7:123. B.R. 249. G.C. II. 11:274. A.F. II:1023. J.H. III. 49:281. G. 5:481. H.U. 5, p. 1.—One of the best rafter plants for warm greenhouses; blooms profusely in early winter.

ALFRED REHDER.

PYRULÀRIA (diminutive of *Pyrus*; alluding to the shape of the fr.). *Santalaceæ*. OIL-NUT. BUFFALO-NUT. A shrub in E. N. Amer. and 2 trees in the Himalayas with alternate, deciduous, entire lvs. and greenish fls. in spikes or racemes; fls. subdioecious, apetalous;



3265. *Pyrostegia venusta*. ($\times \frac{1}{2}$)

sepals and stamens 4–5; filaments short; ovary inferior, 1-celled, with 2–3 ovules: fr. a 1-seeded drupe. The species in cult. is *P. pubera*, Michx. (*P. oleifera*, Gray). A straggling shrub, to 12 ft., puberulous while young; lvs. short-petioled, obovate-oblong, acute or acuminate, cuneate at the base, minutely punctulate, 2–6 in. long; spikes terminal, few-fl'd.; calyx 5-cleft; fr. pear-shaped or subglobose, yellowish, about 1 in. long, crowned by the ovate calyx-lobes, containing an acrid oil like the whole plant. May. Pa. to Ga. and Ala. B.B. (ed. 2) 1:641.—Of no particular ornamental value, but botanically interesting; half-parasitic on the roots of *Tsuga* like *Buckleya*, which see for cult. ALFRED REHDER.

PYRUS (Latin name of pear tree). Sometimes spelled *Pirus*. *Rosaceæ*. THE POME-FRUIT, as all the kinds of pears, apples, and crab-apples; also many small trees and bushes grown for the very handsome early flowers and sometimes for the attractive habit, foliage, and little fruits.

Woody plants, bearing mostly on spurs, with simple but sometimes lobed alternate lvs. (pinnatifid sometimes in *P. heterophylla*): fls. usually perfect, but rarely polygamous, regular, in spring; torus urn-shaped and attached to the carpels and finally closing over them,

and with them becoming fleshy in fr.; calyx-lobes 5 and persistent upon the top of the young fr., or in some cases falling away at maturity or before; petals 5, white or red, perigynous; stamens 15–20 or more; styles 2–5, crowning a 2–5-loculed inferior ovary in which the locules are usually 2-seeded. (Figs. 3266,



3266. Flowers of apple. The ovaries are shown in the section, an ovule being at O.

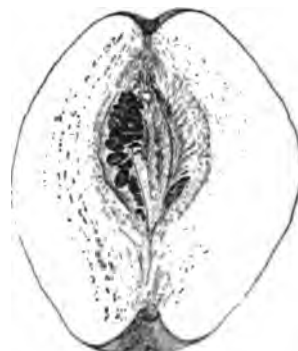
3267). *Pyrus* is a polymorphous genus, in the northern hemisphere. The species are mostly small trees, bearing clusters of showy white or bluish fls. with the lvs. or in advance of them. They are natives mostly of cool temperate regions, and the greater part of them are hardy in the northern United States. There are widely unlike practices among botanists in defining this important and interesting genus. Half a century ago, when it was a widely prevalent practice to assemble groups which agree in general gross structure and which can be held together by a broad definition, *Pyrus* was held to include not only the pears and apples, but the mountain-ashes or sorbus, the medlar and quinces, the chokeberries and other groups (Bentham & Hooker, *Genera Plantarum*, 1867). As late as 1894, Focke (Engler & Prantl, *Pflanzenfamilien*) holds *Pyrus* intact except for the separation of *Cydonia* and *Mespilus*. While many botanists still hold most or all of these groups in *Pyrus*, the present tendency to segregate all groups for which separate definitions can be found results in the dismemberment of *Pyrus*. As the old rather gross assemblage, resulting from the effort to find agreements, can hardly be expected to hold, so the present disunion, resulting from the effort to find differences, may be expected to pass, and the practicable and convenient grouping may be found somewhere between the two extremes. There seems to be good justification for the separation of *Cydonia* and *Mespilus*, and perhaps also for *Sorbus* and *Aronia*, but it is yet to be determined whether the separation of *Malus* (the apples) will meet with continuing favor. See *Malus*, p. 1973, Vol. IV. The many-seeded carpels of *Chenomeles* (Figs. 3268, 3269) and *Cydonia*



3267. Longitudinal section of flower of *Pyrus Halliana*.



3268. Lengthwise section of *Chenomeles Maulei*, by some referred to *Pyrus*, to show many-seeded cores and the lack of peduncle.



3269. Lengthwise section of *Chenomeles cathayensis*.

and the absence of fr.-stalk (Fig. 3270) afford good structural characters, as well as the fl.-bearing habit and other characters. Many of the species that have been named under *Pyrus* will be found in *Sorbus*.



3270. Sessile fruit of *Chamaemeles* Maulei.

If the genus is held to comprise the pears and apples and no others (*Pyrophorum* and *Malus*), there are probably fifty or sixty species.

The aronias, by some kept as a distinct genus (page 396, Vol. I.), comprise a small group of North American bushes with white flowers in corymbs and attractive little fruits.

Under *Pyrus*, the names are *P. arbutifolia*, Linn., the red chokeberry; *P. atropurpurea*, Bailey, the purple chokeberry, sometimes regarded as a variety of the former; *P. melanocarpa*, Willd., the black chokeberry; *P. floribunda*, Lindl. (not Hort.), of garden origin.

The fruit of *Pyrus* is of the kind known to botanists as a pome. The morphology of the pome is still perhaps a subject of disagreement, although most botanists now consider it to be a hollow torus (receptacle), or hypanthium, or cupula, in which the ovary is imbedded. Fig. 3271 illustrates the theoretical structure. The ovary is at *b*, wholly inclosed in the fleshy torus *a*. Most of the edible part of the apple or pear, therefore, is considered to be torus, whereas the core is ovary. This ovary, in common apples and pears, is of five carpels or cells, as shown in the cross-section (Fig. 3272). It was formerly held that the edible part is largely calyx-tube, but various morphological considerations have inclined students to regard it as stem rather than calyx; the term calyx-tube is still retained, however, in descriptive writings. One of these considerations is the fact that apples sometimes bear a rudimentary leaf (as in Fig. 3273), an organ which is commonly borne only by stems.

Apples sometimes take on most unusual and grotesque shapes, and two or more fruits may coalesce into one. Some of these forms, from an orchard of Pearmain, are shown in Fig. 3274. These malformations may be due in part to insufficient pollination, although such teratologies are yet to be well explained.

Aside from the pomological pears and apples, the genus *Pyrus* as here defined includes many very attractive small trees and shrubs. The outlying pear species are not much grown, although well worth cultivation for

interesting foliage and for good white spring bloom. *P. salicifolia*, *P. elaeagnifolia*, and *P. betulifolia* are among the best of these, and the only ones that are likely to appear in collections. The silvery foliage of the first two is attractive. They are hardy in the northern states and probably in Ontario.

It is among the crab-apples, however, particularly of

the Asiatic species, that the most ornamental plants are to be found. Some of them, as *P. pulcherrima* (*P. floribunda*) and *P. Halliana*, have long been popular, but several others are fully as good and it is possible to secure considerable variety. All the species included in the numbers 21 to 36 in this account are probably hardy in parts of New York state and some of them can be grown in Canada. *P. baccata* is hardier even than the common apple tree, and is therefore sometimes used for

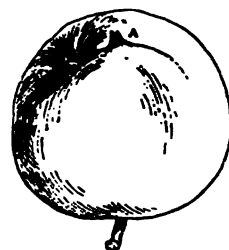
stocks and as a parent in hybridizing. All these crabs may be raised as seedlings, for they bloom profusely when only a few years old, or they may be grafted on any of the related stocks. The Asiatic crabs are profuse bloomers, and the pink-and-white effect of blossoms and buds as the leaves are unfolding or just preceding the leafage constitutes one of the most charming prospects in the spring plantation. Some of them hold their small berry-like

fruits well into the winter, or even to spring, affording a continuing interest. They are of the easiest culture in well-drained soil. All the species are probably subject to scale, and they should be well sprayed. Particularly to be recommended for the central and northern states east of the Great Lakes are *P. pulcherrima*, *P. Halliana*, *P. Scheideckeri*, *P. Sieboldii*, *P. prunifolia* var. *Rinki*, and *P. Sargentii*, the last a bush with pure white flowers.

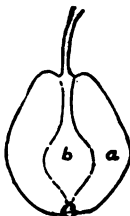
The native American crabs, described in numbers 37 to 45 in this list, are yet little known to planters, but they comprise much promising material, and they should yield horticultural subjects for the entire area of the United States, outside the semi-tropical regions, and for good parts of Canada. As a class they bloom later than the Asiatic species. As yet, only *P. ioensis* appears to have yielded a good double-flowered form. With the recent botanical discrimination in this interesting group, attention will probably be called to a closer study of the forms by collectors. They are easy of culture, and may be readily increased by grafting.

Hybridizing will probably play an important part in the horticultural development of the ornamental crabs, as they cross freely. It is probably due to this cause that the Asiatic forms are so difficult to distinguish botanically. The pears and apples appear not to intercross, although the curious *P. auricularis* is generally considered to be a hybrid between the pear and the beam-tree (*Sorbus Aria*).

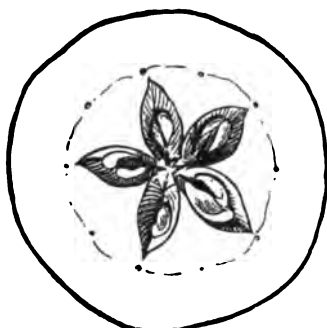
The pear may be made to grow for a time when grafted on the apple, but it is usually impossible to graft the pear species permanently on the apple species with any degree of success; yet pears thrive on quinces and also on hawthorns, which are well-marked genera. In nursery practice when pear stocks are not at hand, long pear cions may be worked on apple pieces and roots may form from the cion and the pear become own-rooted on the failure of the apple stock. Apples appear not to be successful on pears.



3273. A pome bearing a rudimentary leaf (at *a*).



3271. Diagram of a pome (pear). Showing the torus part at *a* and the ovary part at *b*.



3272. Section of a pome (apple). Showing the interior or ovary part and the exterior or torus part.

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THE TWO GROUPS.

1. PEARS (*Pyrophorum*).—Fr. either with a conical base or possessing a cavity like an apple, the flesh bearing grit-cells (unless ripened off the tree); styles usually free or not united at the base; calyx-tube or hypanthium closed by a cushion-like formation, in fl.; fls. white. Species 1-18. Of these plants there are perhaps 15-20 species, native to S.-Cent. Eu. through the Grecian-Asia-Minor-Syrian region to China. There are no representatives indigenous so far as known, in N. Amer. or Japan.

2. APPLES (*Malus*).—Fr. usually with a distinct depression at either end, the flesh without grit-cells; styles more or less united below; calyx-tube or hypanthium open; fls. pinkish, rose-color or light red, sometimes clear white. Species 20-45. There are probably 40 good species of this subgenus, of wide distribution. The common apple, *P. Malus*, is probably indigenous in S. W. Asia. In

Siberia, China, and Japan, several species are native, of which the best known are the smooth-growing crab trees with small frs. that shed their calices. In N. Amer. is another set, represented by the Garland crab, *P. coronaria*, the Prairie States crab, *P. ioensis*, and the far western crab, *P. fusca*. The American forms have recently been re-defined into several species, the actual limitations of which

3275. *Pyrus communis*. (×¼)

are yet to be determined. It has been difficult to find good characters to separate the small-fruited apples, particularly the Asiatic forms. Carrière attempted to solve the difficulty (*Pommiers microcarpes*, Paris, 1883) by referring them all to one polymorphous species-group, *Malus microcarpa*. The recent study of the Asiatic material, however, has resolved it into a number of well-marked species-forms.

I. PYROPHORUM, or PYRUS proper. The Pears.

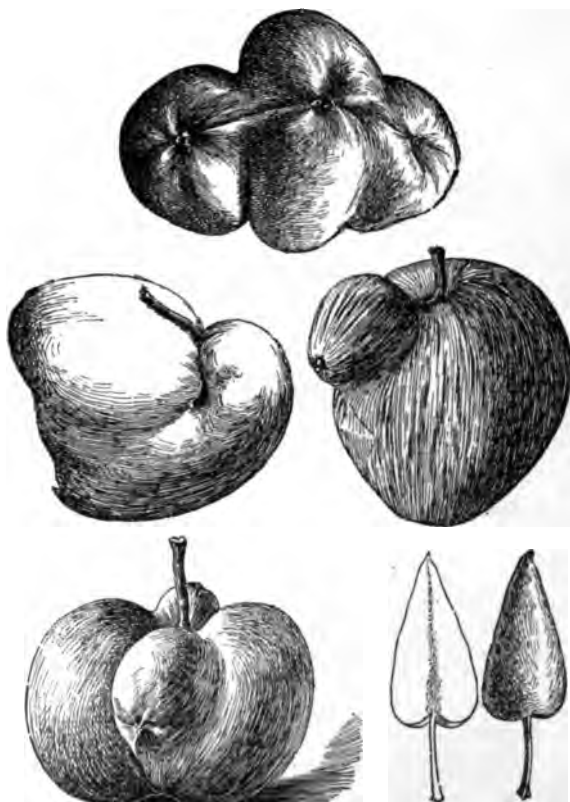
A. The occidental or Eurasian pears, being the common pomological pears of this country: lvs. appressed or crenate-serrate or entire (at least not setose-serrate), mostly abruptly pointed; calyx usually persistent at apex of fr.

1. *communis*, Linn. COMMON PEAR. Figs. 3275; also Figs. 2805 and others, p. 2505 and following. Strong upright tree, living to a great age and sometimes attaining a height of 75 ft. and a girth of 15 ft. and more, the lvs. on short spurs as well as on the axial growths, the pedicels and sometimes the young growth pubescent, but all parts becoming glabrous: lvs. mostly oblong-ovate, with a prominent point, hard in texture and veiny, bright green, the serratures small and much appressed and obtuse, or sometimes the lf. is almost entire: fls. 4-12 in umbel-like clusters on slender (2-3-in.) pedicels, white, appearing with the lvs.; calyx persistent, or rarely deciduous; stamens 15-20: fr. very various under cult., usually tapering to the st., the flesh generally with gritty concretions. Native to S. Eu. and Asia, where it has been cult. from the earliest times.—Probably indigenous as far east as Kashmir. In the Syrio-Persian region are several very distinct pyruces of the pear group, a number of which may be outlying forms of *P. communis*. In the wild in Eu., various thorny and small-fruited forms are known.

Var. *Pyraster*, Linn. Much like the type of *P. communis*, but the fr. globose: lvs. more rounded, strongly serrate, glabrous when young: usually thorny. Probably a wilding form.

Var. *sativa*, DC. The cult. pear, in many pomological forms, the tree large and free-growing and without thorns: lvs. large.

Var. *cordata*, Hook. f. (*P. cordata*, Desv.). A spiny shrub, wild in England and France: lvs. smaller than in the type (about 1 in. broad), ovate or nearly orbicu-

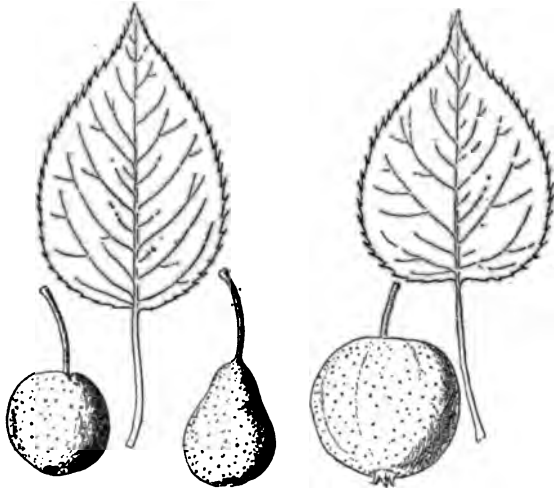


3274. Undeveloped, misshapen and coalesced apples, all from one orchard of Pearmain.

lar, subcordate: fls. smaller: fr. globose to slightly turbinate, about $\frac{1}{2}$ in. diam.; calyx persistent.

There are garden forms of *P. communis*, differing in foliage, as var. *trilobata*, Hort., lvs. lobed; var. *heterophylla*, Hort., lvs. cut; var. *variegata*, Hort., lvs. variegated. In Algeria is var. *longipes*, Henry (*P. longipes*, Coas. & Dur.), a small tree with few spines: lvs. with long slender petiole, ovate, acuminate, subcordate, about 2 in. long and 1 in. broad: fr. globose, about $\frac{1}{2}$ in. diam., the calyx deciduous. In Spain is var. *maritima*, Willk., a small tree, with ovate lvs. about 1 in. long, rounded at base, on very long slender petiole: fr. globose, about $\frac{1}{2}$ in. diam., the calyx persistent.

2. *nivalis*, Jacq. SNOW PEAR. Tree, without thorns, the shoots grayish pubescent: lvs. 2-3 in. long, elliptic to oval to obovate-oval, obtuse or short-acute, cuneate at base, entire or toward apex minutely crenulate, gray-pubescent: fls. large, white, showy: fr. small, roundish pyriform, late-ripening, acid, becoming sweet when overripe. Austria, and wild in France and elsewhere, but probably as an escape.—The snow pear is a small tree, with thick shoots that are white- or gray-hairy when young. It is grown in parts of Eu., particularly in France, for the making of perry or pear cider, the greater part of such varieties being of this species. By some writers it is considered to be a form of *P.*



3276. *Pyrus serotina*. ($\times \frac{1}{2}$)

3277. *Pyrus ussuriensis*. ($\times \frac{1}{2}$)

communis, and by others to be a hybrid race of *P. communis* and *P. amygdaliformis*; Schneider, however, places it as a good species with which he associates other names as synonyms and varieties, and according to his view *P. salicifolia*, DC. (sage-lvd. pear of the French), is *P. nivalis* \times *P. communis*. It is not known to be in cult. in this country, but it is to be looked for in arboreta and other collections. Said to be called "snow pear" because the frs. are fit for eating after snow falls.

The following related species may be expected to appear now and then in trade-lists or in special collections:

3. *P. amygdaliformis*, Vill. (*P. parviflora*, Desf. *P. cuneifolia*, Guss. Probably *P. sibirica*, Dum.). Shrub or small tree (to 30 ft.), spiny, with lightly tomentose buds and young branches: lvs. thick and coriaceous, 1-2 in. long, narrow-elliptic, oblong-lanceolate or oblong-oblancoate, at apex short-acuminate or rounded-mucronate, mostly narrowed or cuneate at base, tomentose when young but becoming nearly or completely glabrous, the petiole short or slender and mostly glabrous, the margin entire or on large lvs. serrulate: fr. nearly globular, $\frac{3}{4}$ in. diam., green and hard. France to Asia Minor, in mountainous places. B.R. 1484 (as *P. nivalis*). G.W. 14, p. 286.—The names *P. Michauxii*, Bosc., *P. persica*, Pers., and *P. oblongifolia*, Spach, probably represent hybrids of this species with *P. nivalis*.

4. *P. auriculata*, Knoop (*P. irregularis*, Muenchh. *P. Polleëria*, Linn. *P. Bollyleriana*, DC. *Sorboipyrus auriculata*, Schneid.). Regarded as a hybrid of *P. communis* and *Sorbus Aria*;

was discovered about 1650 at Bollweiler, in Alsace: it bears very sparingly, and apparently does not come true to seed: to 50 ft., with buds and branchlets tomentose: lvs. 3-4 in. long, elliptic, unequal and rounded at base, short-acuminate, irregularly and coarsely sharp-serrate or double-serrate, lower surface pubescent: fls. 5 or more in tomentose clusters, on slender pedicels; calyx-tube and lobes tomentose; styles 2-5: fr. 1 in. diam., pyriform, reddish yellow, sweet. Now and then planted in botanic gardens and elsewhere. B.R. 1437. L.B.C. 11:1009.—*P. maliotica*, Hort. (and Spach?) is probably a hybrid of similar or related origin.

5. *P. elaeagnifolia*, Pall. (*P. nivalis* var. *elaeagnifolia*, Schneid.). Small spiny tree, the young shoots tomentose: lvs. lanceolate to oblong or obovate-lanceolate, entire, usually silky-tomentose, the base mostly tapering and the apex obtuse-mucronate or short-acuminate: fls. small, on densely tomentose pedicels: fr. globose-turbinate, glabrous, the calyx persistent. Caucasus, S. Russia. The specific name was first written, by Pallas, *elaeagnifolia* (not *elaeagnifolia*), because he considered *elaeagnus* to be the proper spelling of the name of the oleaster genus, it having been spelled that way by Dioscorides. Var. *Kotschyana*, Boiss. (*P. Kotschyana*, Boiss. *P. nivalis* var. *Kotschyana*, Schneid.), is usually spineless, the lvs. larger (3 in. long), the fr. globose and larger (about 1 in. diam.).

6. *P. heterophylla*, Regel & Schmalh. Small thorny glabrous tree, with very variable foliage, some plants having lvs. that are entire at the margin, others are slit and almost of thread-like form, but the greater number with forms intermediate between these two extremes, usually ovate in outline, but mostly pinnatifid and the segms. again toothed: fr. nearly globose with the ends somewhat flattened, about 1 in. diam. Turkestan. G.C. III. 7:115.

7. *P. Korshinskii*, Litw. Tree, to 30 ft. or more, or a shrub, with branchlets and buds gray-tomentose: lvs. coriaceous, about 3 in. long, lanceolate or ovate-oblong, somewhat tomentose above and beneath, the margins with coarse crenate or double-crenate incurved gland-tipped serratures, the petiole long and tomentose: fr. nearly globose, stout-peduncled, nearly 1 in. diam., with persistent calyx. Bokhara, Turkestan.

8. *P. salicifolia*, Pall. Small tree, often spiny, becoming 30 ft. tall, with gray-tomentose branchlets: lvs. willow-like, 2-3 in. long, (whence the name), linear-lanceolate or lanceolate, mostly tapering toward both ends, entire or very nearly so, hoary beneath: fls. white, in corymbs, short-pedicelled: fr. round-pyriform, short stemmed, yellow or greenish, about $\frac{1}{2}$ in. diam., the calyx persistent. Caucasus, Armenia. G.C. II. 14:145. G. 34:305.—A showy spring-flowering small tree, hardy in the northern states, and worthy of being better known. Var. *pendula*, Hort., has drooping branches. G. 22:649. *P. confuciana*, Spach, is perhaps a form or hybrid of *P. salicifolia*: lvs. lanceolate or narrow-elliptic, about $2\frac{1}{2}$ in. long, at apex acute or mucronate, minutely crenulate, sometimes twisted, tomentose.

AA. The oriental or Chino-Japanese pears, grown in this country to some extent for ornament and fr., and producing hybrids with *P. communis*: lvs. mostly markedly acuminate and very sharp-serrate or setose-serrate: calyx usually falling from the apex of the fr. in the cult. forms (not so in *P. ussuriensis* and *P. ovoidea*). (See Rehder, Synopsis of the Chinese Species of *Pyrus*, Proc. Amer. Acad. Arts and Sci. 50:225-40; also Plantæ Wilsonianæ, 2:263-6.)

9. *serotina*, Rehd. Fig. 3276. Tree, 20-50 ft., the branchlets glabrous or becoming so: lvs. ovate-oblong or seldom ovate, 3-5 in. long, rounded at base and rarely subcordate or cuneate, long-acuminate, strongly and sharply setose-serrate, with partially appressed serratures, when young villous or beneath cobwebby but becoming glabrous: infl. umbellate-racemose, 6-9-flid., glabrous or somewhat tomentose, the pedicels slender: fls. white; sepals or



3278. *Pyrus ovoidea*. ($\times \frac{1}{2}$)



3279. *Pyrus Lindleyi*. ($\times \frac{1}{2}$)

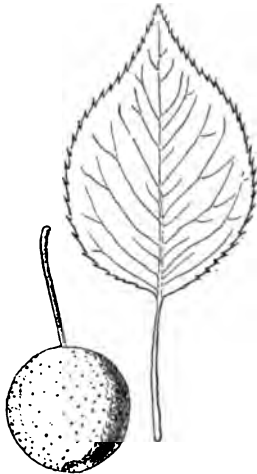
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XCIV. The bloom of *Pyrus pulcherrima* (*P. floribunda*).

calyx-lobes triangular-ovate and long-acuminate, $\frac{1}{4}$ to about $\frac{1}{2}$ in. long, glandulose-denticulate; petals oval, short-clawed, nearly $\frac{3}{4}$ in. long; stamens about 20; styles 4 or 5, glabrous; fr. subglobose, brown, slender-stalked, the calyx deciduous. Cent. and W. China. B.M. 8226 represents a form named by Rehder var. *Stapfiana*, differing in pyriform fr., less appressed serratures on the lvs., and petals attenuate-clawed.



3280. *Pyrus Bretschneideri*.
($\times \frac{1}{2}$)

P. serotina or its forms is recommended on the Pacific Coast as a more or less blight-resistant stock for the European types.

Var. *culta*, Rehder. (*P. sinensis*, Hort., not Lindl. nor Poir. *P. sinensis* var. *culta*, Makino). SAND PEAR. Fig. 2808, p. 2507, the details of lf.-margins not showing. JAPANESE and CHINESE PEAR of pomologists. Differs from the type of the species in its large pyriform or apple-form fr., larger and broader lvs. (which are often 6 in. long and 3-4 in. broad). Japan.—A very rapid-growing tree, with strong, thick shoots: lvs. broadly ovate and long-pointed, very dark green, the margins thickly furnished with very sharp, sometimes almost bristle-like teeth: fls. large, appearing rather in advance of the foliage: fr. hard and usually roughish, commonly with a depression or "cavity" about the st., the flesh tough and gritty and poor in flavor, the calyx usually falling before maturity. R.H. 1879:170; 1880:110 (as *P. Sieboldii*).—Known in this country in a number of varieties, as Chinese Sand, Japanese Sand, Hawaii, Madame von Siebold (which pomological variety Rehder writes, "may be considered as representing the type" of var. *culta*), Mikado, Diamyo, Gold Dust. The frs. are often remarkably apple-like, especially in the russet varieties, but they are distinguished by the long st. and pear-like flesh. The Japanese pear is little prized for its fr. although the pears are useful for preserving and some of the varieties are showy and the frs. are good keepers; it is used for stocks upon which to work the common pear, and it has given good results in hybridizing. It is an excellent ornamental tree, being a clean grower of great vigor. Kieffer, Le Conte, and others are hybrids of *P. communis* and *P. serotina* var. *culta* (Figs. 2809-2810). This type has a stronger growth than the common pears, the lvs. are usually broader and darker green, with closely and mostly obtusely serrate edges, the fr. is more or less pyriform and of better flavor than that of the oriental parent, and the calyx is either persistent or deciduous. Seedlings of Kieffer often produce the sharply toothed lvs. of *P. serotina* var. *culta*.

Other oriental pears are likely to appear in cult., and it is necessary to distinguish them briefly.

A. Calyx persistent: fr. yellow.

B. Lvs. setosely and sharply serrate.

C. Fr. globose or subglobose, short-stalked: lvs. orbicular-ovate or ovate, these and infl. glabrous from the first.

10. *P. ussuriensis*, Maxim. Fig. 3277. Differs from its allies, according to Rehder, chiefly in the short stalk of the fr. which is globose and has a persistent calyx, in the broad often nearly orbicular strongly setose-serrate lvs., and in the lighter yellowish brown color of the branchlets; fl.-clusters rather dense and hemispherical, owing to the short stalks: petals obovate and rather gradually narrowed toward base; styles distinctly pilose near the base. Manchuria, Amoorland, N. China. R.H. 1872, p. 28 (as *P. Simonii*, Carr.).—Sometimes spiny; branches often yellow-gray.

CC. Fr. ovoid, long-stalked: lvs. oblong-ovate or ovate, these and the infl. at first more or less floccose-tomentose.

11. *P. ovoidea*, Rehder. Fig. 3278. Differs from *P. ussuriensis* chiefly in the narrower lvs., darker-colored branches, and longer-stalked longer-shaped fr. which has spreading persistent sepals: in longitudinal section the yellow juicy fr. is described as exactly ovate, broad and rounded at the base, tapering from the middle toward a truncate apex, thus constituting a pear of unusual and distinct shape. China.—Blossoms a week ahead of other species of pears: the foliage turns bright scarlet in autumn. Hardy N. Sometimes grown as *P. Simonii*.

BB. Denticulate or serrate but the serratures not setose-acuminate: fr. oval in outline, long-peduncled.

12. *P. Lindleyi*, Rehder. (*P. sinensis*, Lindl., not Poir.). Fig. 3279. Known only from Lindley's descriptions and figure, and perhaps a cult. form of some other species: the lvs. have short and rather small appressed teeth that are not at all acuminate, or those on the short growths nearly crenate-serrate; in shape ovate and abruptly acuminate, rounded at the base and those on the short branchlets mostly subcordate. China. B.R. 1248 (as *P. sinensis*). Lindley's name, *P. sinensis*, has long been used for the sand pears, which plants must now bear the name *P. serotina* var. *culta*.

AA. Calyx falling: fr. yellow or brown.

B. Lvs. setosely serrate: fr. yellow.

13. *P. Bretschneideri*, Rehder. Fig. 3280. Medium-sized tree, closely allied to *P. ovoidea* but distinguished by the deciduous calyx and the ovate or elliptic-ovate-acuminate lvs. which have a broadly cuneate or very rarely a rounded base; lf.-margins sharp-serrate, at first setose-acuminate but serratures becoming only acuminate and somewhat appressed: fr. subglobose or globose-ovoid, about 1 in. long and nearly or quite as thick, the base contracted into a stalk 1-1½ in. long, hanging, yellow and marked with pale dots. China.—Supposed to be the species that yields some of edible pears of Peking. Hardy N.

BB. Lvs. sharply serrate or dentate-serrate but the serratures not setose: fr. brown.

C. Styles 2-3: lvs. mostly coarsely dentate-serrate, the base usually broadly cuneate. fr. very small.

14. *P. betulifolia*, Bunge. Fig. 3281. Tree, to 20 ft., without thorns, the buds and branchlets gray-tomentose, the head rather narrow, the foliage pale and the fls. rather small: lvs. ovate-acuminate or rhombic-ovate-acuminate, cuneate at base, long-stalked, sharp-serrate, becoming shining green above, pale tomentose or glabrous beneath: fls. white, $\frac{3}{4}$ in. across, the styles and cells of ovary 2: fr. nearly globular, size of a pea, brown and dotted, the calyx falling. China. Hardy in New England and Canada. R.H. 1879, pp. 318, 319. G.F. 7:225 (reduced in Fig. 3281). A.F. 13: 1398. Gng. 6:309.—A worthy plant for ornament, bearing a profusion of fls. in advance of the lvs. or at the time of the expanding of the lvs. It has been used as a stock for some of the pomological pears. It is subject to pear-blight.

15. *P. Calleryana*, Decne., although Chinese, in lf. resembles the crenate-serrate Eurasian type rather than the sharp-serrate or



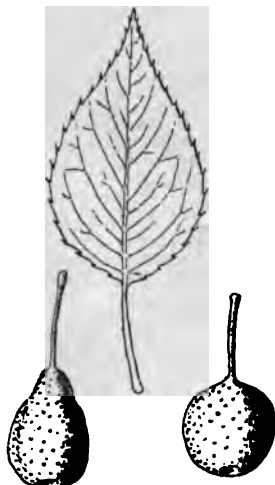
3281. *Pyrus betulifolia*.
($\times \frac{1}{2}$)

setose-serrate Chino-Japanese type: lvs. ovate, mostly rounded at base, small, crenate, glabrous; fls. small, with only 2 or 3 styles, in a glabrous infl.; stamens about 20; fr. size of a pea, globular but contracted abruptly into a long slender stalk, calyx deciduous.

cc. Styles 3 or 4, sometimes 5: lvs. mostly rounded at base: fr. mostly larger.

D. Lf.-margins strongly serrate, with acute or somewhat appressed serratures.

16. *P. serrulata*, Rehd. Small tree, most closely related to *P. serotina* but distinguished by the not-setulose serratures, shorter lvs., smaller fls. with styles less than 5, triangular-ovate rather than long-acuminate sepals or calyx-lobes, and subglobose or globose-obovoid brown fr. which is less than 1 in. long. China.—*P. hupehensis*, Pamp., from Cent. China, is probably this species or very closely related: described as a tree with straight slender trunk: lvs. more or less ovate, rounded or cuneate at base, long-acuminate, sharp-toothed, cream-colored beneath: fls. in dense clusters.



3282. *Pyrus phaeocarpa*. ($\times \frac{1}{2}$)

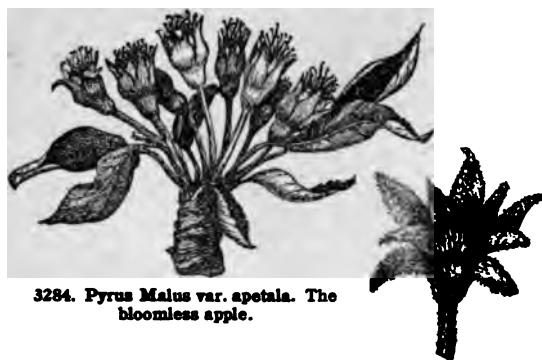
narrow-ovate, 2-3½ in. long, glabrous, subcordate at base, long-acuminate at apex; calyx-lobes broad and rounded and the fls. in glabrous corymbs: fr. globose, 1 in. diam., the calyx early deciduous. Kashmir to Kumaon in W. Himalaya and to Yunnan. B.M. 8256.

DD. Lf.-margins dentate-serrate, the serratures erect-spreading.

18. *P. phaeocarpa*, Rehd. Fig. 3282. Medium-sized tree: lvs. elliptic-ovate or oblong-ovate, attenuated into long point, the base mostly broadly cuneate, the serratures at first more or less incurved but becoming open or spreading: frs. pyriform, about 1 in. long, slender-stalked, brown or russet. China. Var. *globosa*, Rehd., has globular fr. and lvs. usually ovate and round-based. The fls. of *P. phaeocarpa* are unusually large, lvs. deep green and very lustrous; a handsome small tree. Hardy N.

17. *P. Páshia*, Buch.-Ham. (*P. variolosa*, Wall.). Tree, mostly spiny, when young with 3-lobed and doubly serrate lvs. like those of *Crataegus*, the young growths woolly: lvs. ovate or ovate-lanceolate, acuminate, crenulate or serrulate, becoming glabrous: fls. 1 in. diam., mostly in woolly corymbose short-peduncled clusters; calyx-lobes acute, deciduous; stamens about 30. Himalayas to W. China. Var. *kumaoni*, Stapf (*P. kumaoni*, Decne. *P. Wilhelmsii*, Schneid.), in cult. at Kew, is a thornless tree attaining 50 ft., with buds and branchlets glabrous: lvs.

lvs., about 5 or 6 in each cyme; sepals or calyx-lobes 5, acuminate; petals 5, obtuse, mostly pink on the outside; stamens about 20, with yellow anthers: fr. very various, with a cavity about the st., a homogeneous flesh and persistent calyx.—Cult. from remote antiquity, and thought to be native to Eu. and W. Temp. Asia to the Himalayas. It has run wild in many parts of Eu. Attempts are made to recognize two or more species in the group of common apples, but the efforts are not



3284. *Pyrus Malus* var. *apetalis*. The bloomless apple.

very successful in practice. Some authorities consider that there are two original species and that the common pomological apple represents a welding of them through hybridization.

Var. *sylvestris*, Linn. (*Malus sylvestris*, Mill. *M. acerba*, Mérat. *Pyrus acerba*, DC.). Mostly a wild or run-wild nearly or quite glabrous form, to which not many of the cult. pomological varieties can be referred: young branchlets glabrous or soon becoming so: lvs. glabrous above, shining and only scattered-pubescent beneath, the petiole and pedicels only slightly pubescent: calyx-tube and outside of calyx-lobes glabrous but the latter pubescent inside. W. and Cent. Eu.

Var. *pumila*, Henry (*Malus pumila*, Mill. *Pyrus pumila*, Koch). The pubescent type, the source of nearly all the pomological apples, and kept specifically separate by some writers: small or large tree, or bush-like: young branches prominently tomentose, as well as



3283. *Pyrus Malus*, the apple.

II. MALUS. The Apples.

A. The pomological apple-species, grown for their edible frs. (with ornamental forms).

B. Calyx persistent on the ripe fr.

19. *Malus*, Linn. (*Malus communis*, DC. *Malus Malus*, Brit.). APPLE. Fig. 3283; also under Apple, Vol. I. A round-headed tree or a large bush, with foliage clustered on short shoots or spurs and also borne on the slender axial growths: lvs. oval, ovate or orbicular-ovate, mostly pointed at apex and rounded at base, soft in texture, dull, the margins irregularly serrate, on stout petioles: fls. large and showy, white or light rose, in close clusters on short pedicels, appearing with the

are the pedicels, calyx-tube, and both surfaces of the calyx-lobes: lvs. ovate or oval, dull and more or less tomentose beneath. Thought to be native only in S. E. Eu. and in Asia, although run wild elsewhere. A very dwarf form is the Paradise apple (*P. Malus* var. *paradisiaca*, Linn.), used as a stock on which to dwarf the pomological varieties.

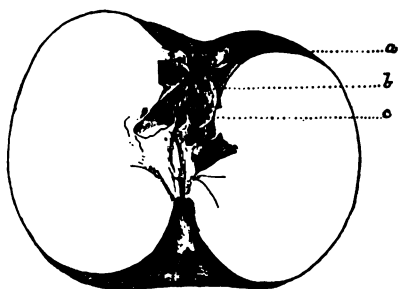
Var. *astracánica*, Loud. (*Malus astracánica*, Dum. *Pyrus astracánica*, DC.). Distinguished by large coarsely serrate or doubly serrate lvs. which are tomen-

tose beneath, and by the long pedicels. Probably Asian.

Var. *Niedzwetzkyana*, Asch. & Graebn. (*Pyrus Niedzwetzkyana*, Hemsl.). Mature lvs. tinged red on midrib and nerves, the fls. deep pink, the flesh of the fr. purplish: wood and bark also red or reddish. S. W. Siberia and Caucasus. B.M. 7975. R.H. 1906:232. F.S.R. 2:344.—A very ornamental tree.

Var. *apétala*, Asch. & Graebn. (*Pyrus apétala*, Muenchh. *P. diota*, Moench). BLOOMLESS APPLE. Figs. 3284, 3285. Fls. with no colored petals, these organs being represented by very small green bract-like or sepal-like bodies, the sepals appearing, therefore, to be in 2 rows; stamens absent; styles 10-15; ovary 6- or 7-celled, perhaps more: fr. (apparently produced by pollination with other apples) much as in common apples except for a deep not closed cavity at the apex, there being one "core" above the other due probably to the crowding of the many cells as the pistil grows; as the apple grows, some or all the cores split open, and cause the hole in the top of the fr.; in Fig. 3285, *b* and *c* represent the persistent points of ruptured core-walls, and *a* marks a thickened petal or bract that stood in the fl. This monstrosity has been long known, and now and then recurs.

There are horticultural forms of *P. Malus* distinguished as: Var. *atrea*, Hort., with yellow-variegated lvs.; var. *plena*, Hort., with more or less double fls.; var. *péndula*, Hort., of weeping or drooping habit.



3285. *Pyrus Malus* var. *apétala*.—The bloomless apple, in longitudinal section.

20. *Soulardii*, Bailey (*Malus Soulardii*, Brit.). SOULARD CRAB. Figs. 3286, 3287. Apparently natural hybrids of *P. Malus* and *P. ioensis*: a small tree, with much the look of an apple tree, and woolly: lvs. large, round-ovate to elliptic-ovate or oblong-ovate, either rounded or tapering at the base, often very blunt or even rounded at the top, mostly bluntly and coarsely serrate or dentate when young, irregularly crenate-dentate at maturity; with a tendency to become lobed, on short pubescent petioles, thick and often rugose and woolly beneath: fls. blush, in close woolly clusters like those of the apple: fr. often 2 in. or even more in diam., flattish lengthwise, yellow and often with a tinted cheek, the basin shallow, flesh fairly edible. Wild in the Mississippi Valley from Minn. to Texas, but always local and in different forms of fr.—Named for James G. Soulard, Galena, Ill., who intro. the first variety to cult. In some forms the lvs. become nearly smooth late in the season and there is little tendency toward an irregular notching or lobing of the margins. The tree is hardy and the fr. keeps well and is useful for culinary purposes. A few named varieties are grown in the upper Mississippi Valley, where trees of great hardiness are demanded. For accounts of the pomological offshoots of our native apples, see Bailey, "Evolution of Our Native Fruits," and Craig & Hume, "Native Crab Apples and Their Cultivated Varieties," Iowa Acad. Sci., 1899.

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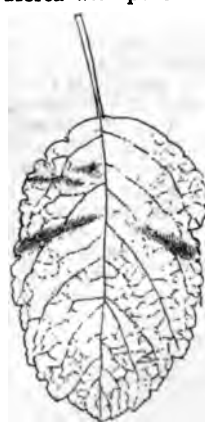
BB. *Calyx falling from the fr.*

21. *baccata*, Linn. (*Malus baccata*, Borkh. *Malus microcarpa* var. *baccata*, Carr. *M. baccata* var. *sibirica*, Schneid.). SIBERIAN CRAB. Fig. 3288. Small round-headed tree, with a compact crown, smooth in all its parts at maturity; growth hard and wiry: lvs. ovate to



3286. *Pyrus Soulardii*. ($\times \frac{1}{4}$)

ovate-lanceolate or ovate-acuminate, thin and glabrous, on slender petioles, finely and nearly evenly serrate, bright green: fls. appearing with the lvs. on long and very slender (2-3 in.) greenish pedicels, white, handsome; style mostly longer than the stamens, lightly hairy or glabrous: fr. from the size of a pea to $\frac{3}{4}$ in. diam., on long, hard sts., yellow or red and firm and often translucent in texture, never becoming mellow, the calyx falling away before maturity. Siberia to Manchuria and N. China. B.M. 6112. M.D.G. 1899:454. Gt. 11:202.—Difficult to distinguish from *P. pulcherrima*: larger, becoming a distinct tree, sometimes as large as a large apple tree: lvs. with blunter teeth, and usually much longer, very slender, hard, glabrous petioles: fls. lighter colored, usually white; vernation convolute (lvs. rolled in the bud). It runs into many forms, particularly in fr. Var. *mandshurica*, Maxim. (*Malus baccata* var. *mandshurica*, Schneid.). Low densely branched tree when growing in the open but tall and wide-spreading in forests: lvs. broader, elliptic or round-elliptic, mostly entire, the petiole, rib, and nerves, as well as infl., more or less hairy: style scarcely as long as the stamens: fr. elliptic, about $\frac{1}{2}$ in. diam. Amur region, Korea, Cent. China, Japan. Var. *himalaica*, Maxim. (*Malus baccata* var. *himalaica*, Schneid.). Lvs. very broad-oval, coarsely serrate, more or less hairy underneath, particularly on midrib. W. Himalaya. A handsome form from Korea with pure white large fls., large dark green lvs.



3287. Mature leaf of *Pyrus Soulardii*. ($\times \frac{1}{2}$)

and large dark red fr., is distinguished by Rehder as forma *Jackii*: from var. *mandshurica* it differs in being glabrous.—The Siberian crabs of pomologists belong to *P. baccata*, but to which of the several botanical forms (if to any of them) is not clearly determined; the species is also used in cold countries as a stock on which to graft the common apple. It is a species of great hardiness, withstanding the climate in the Canadian N. W. provinces. It is much subject to blight (pear-blight) and for this reason its usefulness is much limited. Hybrids with *P. Malus* promise a valuable type of apple for cold regions. See Fig. 648, Vol. I, and pp. 569

and 570. The large-fruited pomological crab-apples of the Hyslop and Transcendent type are supposed to be hybrids between *P. baccata* and *P. Malus*, and to these forms the name *P. prunifolia* has been applied but probably erroneously. The *P. cerasifera*, Spach, is of the *P. baccata* group, and is probably a hybrid: it



makes a large tree with spreading head, and bears very large pure white fls.: the fr. is variable in size, shape, and color, and either retains or drops the calyx.

AA. The oriental "flowering apples" (East Asian, Chino-Japanese) grown in many forms for the ornamental fls. and frs. (Cf. Rehder, *Plantæ Wilsonianæ*, 2:279-95). (Most of these oriental flowering crabs are in cult. only in botanical collections but they are likely to be planted elsewhere, and it is necessary to the determination of most of them that all the others be contrasted.)

B. Lvs. convolute (rolled up in the bud), always undivided.

C. Calyx deciduous from the fr. (In this group belong *P. baccata*, *P. Halliana*, and *P. theifera*; in the first (see No. 22) the calyx-lobes are longer than the tube, narrow-lanceolate, and the fls. white with mostly 5 styles, in these characters being distinguished from one or both of the others.)

22. *Halliana*, Voss (*Malus Halliana*, Koehne). Fig. 3289. Bush or small tree, 6-15 ft. tall, with a loose open crown: lvs. long-ovate, glabrous, leathery, crenate-serrulate, the petioles short: fls. rose-colored, more or less polygamous, hanging on slender reddish pedicels, the calyx-lobes often more or less obtuse, the styles usually 4: fr. size of a pea or somewhat larger ($\frac{1}{4}$ - $\frac{1}{2}$ in. diam.), abruptly contracted into a thickened pedicel, brownish red, ripening late in autumn and containing very large seeds. W. China; cult. in Japan. M.D.G. 1899:457. One of the handsomest of the flowering apples. Var. *Parkmanii*, Bailey (*P. Parkmanii*, Hort.), is the double-fl. form: named for Francis Parkman, the historian, in whose garden near Boston it was first grown in this country. *Malus Hartwigii*, Hort., is a hybrid of German origin, between *P. Halliana* and *P. baccata*.—*P. Halliana* is a beautiful little tree which was recognized among horticulturists before it was described by botanists. The first naming of it in *Pyrus* in such a way as to gain nomenclatorial standing with botanists seems to have been by Voss in Vilmorin's *Blumengärtnerci*, 3d ed., 1896. Rehder distinguishes the species as follows (in Sargent, "Trees and Shrubs," 1:35, from which also Fig. 3289 is reduced): It is allied to *P. baccata*, and *P. pulcherrima*; from the first it is distinguished by the leathery lvs., the color of the fls., the much shorter sepals, the purple calyx and pedicels, and the 4- or 5-celled very late-

ripening fr.; from *P. pulcherrima* it is distinguished by the convolute veneration of the glabrous lvs., the color of the larger fls., the shorter sepals, and the glabrous purple pedicels and calyx. In foliage and fls. it much resembles *P. spectabilis*, which, however, differs by its pubescence and the much larger fr. crowned by the persistent calyx. From other species it differs in its polygamous fls. There is at least 1 staminate fl. in each umbel, and this is always terminal; sometimes there are 2 or 3, but the number of staminate fls. rarely exceeds that of the perfect ones. In the staminate fls. there is no trace of reduced pistils. The species was intro. to American gardens about 1863 by G. R. Hall (see p. 1578, Vol. III).

23. *theifera*, Bailey (*Malus theifera*, Rehd.). A small tree with stiff spreading branches, hardy at Boston, resembling a cherry tree when in bloom, the fls. white or light pink (there is a rose-colored form) with purple calyx and the unfolding lvs. purplish: distinguished from *P. Halliana*, its nearest ally, by larger and broader ovate or ovate-oblong or elliptic-ovate sharply glandular-serrate thinner lvs., longer petioles and less slender pedicels, acute or acuminate calyx-lobes, mostly 3 styles, white or bluish fls., and larger frs. China to Assam.—The fr. is globose, light greenish yellow with reddish cheek, ripening in Mass. in Oct.: fls. fragrant. Not yet grown outside botanical collections, but a handsome free-flowering species. Var. *rosea*, Bailey, has rose-colored fls. and is very beautiful.

24. *sikkimensis*, Hook. f. Small tree, with tomentose branchlets: lvs. ovate to ovate-oblong, 2-3 in. long, not lobed, the apex long-acuminate, abruptly narrowed at base, tomentose beneath, with fine and close sharp-pointed serratures, the petiole much shorter than the blade: fls. 1 in. across, 5-8 in a corymbose cluster, appearing with the lvs., white but pinkish outside, the buds rose-colored; pedicels very slender, $1\frac{1}{4}$ -2 in. long; calyx-tube ellipsoid, the lobes lanceolate and recurved; petals orbicular, claw very short, tomentose; stamens many; styles slender and glabrous, connate below: fr. turbinate, not depressed at base, $\frac{3}{8}$ in. diam., dark red speckled white, the calyx wholly wanting. Himalaya. B.M. 7430.



cc. *Calyx persistent on the fr.*

D. *Style glabrous at base: fr. punctate: lvs. sharply and mostly doubly serrate.*

25. *Prättii*, Hemsl. (*Malus Prättii*, Schneid.). Young growths whitish hairy but becoming glabrescent: lvs. 3-4 in. long, the long petiole extra, ovate-lanceolate to ovate or elliptic, acuminate-acute, the base usually rounded, finely somewhat double-serrate with callous serrations: fls. medium size, in many-fl. terminal subsessile clusters, slender-pedicelled; calyx-lobes acuminate, white-silky inside; petals $\frac{1}{2}$ in. long, short-clawed, rounded at apex, conspicuously veined; styles 5, glabrous: fr. about $\frac{1}{2}$ in. long, ovoid, punctate, the calyx persistent. China.

DD. *Style villous at base: fr. smooth and not punctate: lvs. simply serrate or crenate-serrate.*

E. *Lvs. membranaceous or thin in texture, dull above: calyx-lobes acuminate and longer than the tube.*

26. *prunifolia*, Willd. (*Malus prunifolia*, Borkh. *M. hybrida*, Loisel.). For years considered to be a hybrid of *P. baccata* and *P. Malus* or other species, but a plant which he considers to be a variety of it (var. *Rinki*) having been found wild in China leads Rehder to the conclusion that it is a good natural species; *P. prunifolia* itself is yet known only as a cult. plant: tree,



3290. *Pyrus prunifolia* var. *Rinki* ($\times \frac{1}{2}$). No. 26.

glabrous or the pedicels and calyx more or less tomentose: lvs. much like those of *P. baccata*, but slightly pubescent on veins below and glabrous at maturity: small tree: lvs. 2-3 in. long, ovate to obovate or nearly orbicular, somewhat acute to short-acuminate, the margin with small close somewhat unequal serratures: fls. 6-10 in a sessile cluster, on pedicels 1-1 $\frac{1}{2}$ in. long, white, 1 $\frac{1}{2}$ in. across; calyx-tube obconical, the lobes or sepals lanceolate; petals orbicular or oblong; styles 5, connate below the middle: fr. about 1 in. diam., globose to ovoid, with cavity at base, green, yellow, or red. Probably Siberia. B.M. 6158.

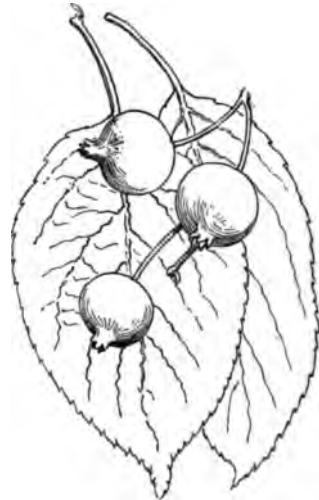
Var. *Rinki*, Bailey (*Malus pumila* var. *Rinki*, Koidz. *M. prunifolia* var. *Rinki*, Rehd. *M. yezoensis*, Koidz. *M. Matsumurae*, Koidz. *M. Ringo*, Carr. *Pyrus Ringo*, Wenz. *P. praecox*, Miq.). CHINESE APPLE. Figs. 3290, 3291. Wide-spreading small tree, to 15 or 18 ft. high, more pubescent than the type (*P. prunifolia*) and representing a more southern range, the petioles shorter and the fls. pink or pinkish rather than white. China. B.M. 8265.—This tree yields an edible apple, sometimes as much as 1 $\frac{1}{2}$ in. diam., of a greenish or yellowish color and with a bitter-sweet flavor; it was formerly grown in Japan for its fr., but its cult. has been discontinued since the intro. of the European apple, yet is now used as stocks for the imported kinds. In China it is still sparingly cult. In botanical characters the plant is much like *P. Malus*, but is distinguished by the much longer fr.-stalk, more sharply serrate and usually less tomentose lvs., the apex of the fr. not

sunken but with a raised calyx which is thickened and fleshy at the base.

EE. *Lvs. paper-like in texture, shining above: calyx-lobes shorter than the tube or only equaling it.*

27. *spectabilis*, Ait. (*Malus spectabilis*, Borkh. *M. sinensis*, Dum.). CHINESE FLOWERING APPLE. Fig. 3292. Small tree, with

darker-colored fls. than those of the apple (the opening fl.-buds almost coral-red), and blooming earlier, making an erect vase-like head: lvs. narrower, oval to oval-oblong, slender-stalked, nearly glabrous on both surfaces or becoming so, usually more closely serrate than those of the apple: pedicels and calyx-tube nearly or quite glabrous: fr. roundish or round-oval, without a cavity at the base, reddish yellow, sour. Probably China and Japan, although unknown wild and very little grown in those countries although well known in cult. in Eu.; the plant called by this name in Japan is probably *P. Halliana* or *P. micromalus*. B.M. 267. L.B.C. 18:1729. Gn. 21, p. 46. Gng. 3:273. G.F. 1:272.—A very handsome early-blooming tree, of which the double-fl. and semi-double forms are most prized. *P. Malus* itself has been disseminated under the name of *P. spectabilis*. Hardy in the northern states. Var. *Riversii*, Booth, has very large half-double bright



3291. *Pyrus prunifolia* var. *Rinki*. ($\times \frac{1}{2}$)

rose-red fls.

28. *micromalus*, Bailey (*Malus micromalus*, Makino. *M. spectabilis* var. *micromalus*, Koidz. *Pyrus Kaida*, Mouill. *Malus microcarpa* var. *Kaida*, Carr. *M. spectabilis* var. *Kaida*, Sieb.). Fig. 3293. Apparently a hybrid, *P. spectabilis* being undoubtedly one of the parents, and probably *P. baccata* or *P. floribunda* the other. From *P. spectabilis* it is distinguished by the narrower lvs. which are gradually narrowed at the base into a slender petiole, by tomentose pedicels and calyx, and the subglobose fr. which has a depression at base and apex, the calyx sometimes deciduous. Cult. in Japan, and said to have been intro. from China;



3292. *Pyrus spectabilis* ($\times \frac{1}{2}$). No. 27.

unknown in the wild.—A useful and showy plant, bearing profusely of bright red fls., with red calices and pedicels, and holding its many little frs. well into winter or even all winter.

BB. Lvs. *conduplicate* (folded together lengthwise face to face in the bud), those on the strong shoots often lobed.

c. Calyx persistent.

29. *Tschonoskii*, Maxim. (*Malus Tschonoskii*, Schneid.). Fig. 3294. Tree, 30–40 ft. with erect and open habit: lvs. ovate-acuminate, coarsely serrate, with sharp teeth, shining and pilose above although tomentose when young, somewhat tomentose beneath: fls. 2–5 together, white tinged rose, on whitish hairy pedicels about $\frac{1}{2}$ in. long; calyx-tube whitish hairy, the lobes or sepals ovate-acute, spreading in fl.; petals about $\frac{1}{2}$ in. long: fr. obovoid, about 1 in. diam.; calyx-lobes persistent, erect or nearly so, white-tomentose, 1 in. or less diam., yellow with a rosy cheek. Japan. B.M. 8179. G. F. 7:55 (reduced in Fig. 3294).



3293. Fruit of *Pyrus micromalus* in winter. ($\times \frac{1}{2}$)

30. *yunnanensis*, Franch. (*P. Vetchii*, Hort. *Malus yunnanensis*, Schneid. *Eriolobus yunnanensis*, Schneid.). Distinguished from *P. Tschonoskii* by its smaller fls. in many-fl. clusters, much smaller frs. which are red and with reflexed calyx-lobes, and by the lvs. which are more distinctly lobed and sharply close-serrate: a handsome tree with spreading branches: lvs. simple, broadly ovate, with closely or finely toothed lobes: fr. small, $\frac{1}{2}$ in. or less long, produced abundantly. China. G.M. 56:897.

cc. Calyx deciduous.

D. Styles glabrous at base: fr. ovoid: lvs. prominently lobed.

31. *transitoria*, Batal. (*Malus transitoria*, Schneid.). Young twigs, lvs., and infl. more or less felty: lvs. more or less acute, 3-lobed, about 1 in. diam., petiole about $\frac{1}{4}$ in. long: infl. 3–8-fl.; peduncle, receptacle, and calyx felty; petals broad-oblong, somewhat emarginate, small-clawed, 5 times as long as the calyx; stamens 15; styles 5 (rarely 4), more or less grown together, naked: fr. globose, more or less hairy, about $\frac{1}{4}$ in. diam. China. Var. *toringoides*, Bailey (*P. transitoria* var. *toringoides*, Rehd.), is larger and more vigorous, the lvs. partly entire, frs. larger. W. China.

DD. Styles villous at base: fr. ovoid: lvs. prominently lobed.

32. *kansuensis*, Batal. (*Malus kansuensis*, Schneid. *Eriolobus kansuensis*, Schneid.). A distinct species, marked by the usually broad-ovate 3–5-lobed and sharp-serrate glabrous or glabrescent lvs. which are 3-nerved at base, and by the ovoid red fr. from which the calyx is deciduous: young twigs glabrous, red-brown; buds of the same elongate, acute; scales only finely ciliate: lvs. dark green above, somewhat glandular on the nerves, somewhat paler beneath, glabrous or slightly hairy on the nerves, subrotund in outline, upper half palmately 3-lobed, lobes triangular, acute, margin serrate, the side lobes somewhat shorter; petiole $1\frac{1}{2}$ in. or less long: infl. a false umbel; calyx

acute, equaling the corolla; petals round, short-clawed, more or less hairy inside; stamens 20; styles 3, hairy and grown together at base: fr. purple, 3-celled, about $\frac{1}{2}$ in. long. China.

DDD. Styles villous at base: fr. subglobose.

E. Fls. white, the petals nearly orbicular and at base contracted into a claw.

33. *Sargentii*, Bean (*Malus Sargentii*, Rehd.). A low bush, much branched, the branches rigid and often spinescent: lvs. ovate to elliptic-oblong or ovate-oblong, about 2–3 in. long, sharply and unequally serrate, slender-petioled, those on the vigorous branches mostly ovate and 3-lobed: fls. pure white, 1 in. across, in 5- or 6-fl. clusters, on glabrous pedicels about 1 in. long; calyx-tube and lobes glabrous outside and villous inside, the lobes ovate-lanceolate and acuminate; petals about twice as long as calyx-lobes, oval, short-clawed, glabrous; stamens 15–20; styles usually 4 (rarely 3 or 5), connate and villous below the middle: fr. subglobose, $\frac{1}{2}$ in. or less diam., dark red with a slight bloom. Japan. S.T.S. 1:37. G.C. III. 57:291 (as *P. Malus Sargentii*); 58:309 (fr.). G.M. 58:278.

EE. Fls. reddish (varying to nearly white), the petals cuneate or rounded at base, obovate or oblong.

34. *Siëboldii*, Regel (*Malus Siëboldii*, Rehd. *Pyrus Toringo*, Sieb. *M. Toringo*, Sieb. *P. Mëngo*, Sieb. *M. microcarpa* var. *Toringo*, Carr.) Fig. 3295. Shrub: lvs. ovate or oblong-ovate in outline, pubescent, becoming colored in autumn, strongly notched or lobed on either side at or below the middle, the middle lobe often notched again near the top, the remaining margins sharply dentate: fls. small, bluish, on slender sts.; styles 3–4, connate at base; sepals triangular-ovate or lanceolate, about equaling the tube: fr. the size of a pea, shedding its calyx, yellow or red. Japan. R.H. 1870:451; 1881, p. 296. Gn. 34, p. 206. M.D.G. 1899:456.—Grown mostly for ornament, but lately recommended as a hardy stock upon which to dwarf the apple. In Japan, the little frs. are gathered after frost and preserved. Upon the fr.-spurs, the lvs. are sometimes only toothed, but upon barren or strong shoots they are prominently lobed and suggest the lvs. of hawthorns. Var. *arborëscens*, Bailey (*Malus Siëboldii* var. *arborëscens*, Rehd.), which is widely distributed in Japan, differs from the type in its more tree-like habit (to 30 ft.), less pubescent, lvs. somewhat larger and usually less deeply divided and often lobed only on the ends of strong shoots, fls. often nearly white, frs. yellow or red. Var. *calocarpa*, Bailey (*M. Siëboldii* var. *calocarpa*, Rehd.), has large handsome bright red fr. and large fls.: lvs. on fruiting branches



3294. *Pyrus Tschonoskii* ($\times \frac{1}{2}$). No. 29.

mostly ovate-oblong and crenate-serrulate, those on the vigorous shoots mostly 3-lobed with the lateral lobes short and broad: distinguished from *P. Zumi* by the 3-4 rather than 4-5 styles and by the lobed lvs.

35. *Zumi*, Mats. (*Malus Zumi*, Rehd.). Low and much-branched tree, to 20 ft., with rounded head and twiggy growth, sometimes 40 ft. tall and with more ascending branches: lvs. long-petioled, oblong to ovate-oblong or elliptic-oblong, $1\frac{1}{2}$ -3 in. long, acute at apex, rounded or narrowed at base, entire or somewhat crenate-serrate, yellowish green above and light green beneath, soon glabrous, those on the ends of vigorous branches lanceolate and usually coarsely dentate: fls. white or slightly pinkish, borne in profusion, about 1 in. across, on loosely villous or glabrous pedicels about 1 in. long; calyx-lobes lanceolate, villous inside and less so outside; petals elliptic, obtuse, rounded at base but short-clawed, opening pink but becoming pure white; stamens about 25; styles 4 or 5, connate for one-third their length, densely villous: fr. $\frac{1}{2}$ in. or less diam., globose, red, the calyx deciduous. Mountains of Cent. Japan. S.T.S. 1:91.—Differs from both *P. Sargentii* and *P. Sieboldii* in the oblong lvs. which are not at all or only slightly lobed, and slender petioles; from *P. Sargentii* also in longer petals rounded at base, glabrous lvs., longer petioles, and erect branches; from *P. Sieboldii* also in differences in foliage, larger fls., larger broader petals rounded at base.

36. *pulcherrima*, Aschers. & Graebn. (*P. floribunda*, Kirchn., not Lindl. *P. Malus floribunda*, Hort. *Malus floribunda*, Sieb. *M. microcarpa* var. *floribunda*, Carr.). FLOWERING CRAB. Unknown in the wild but long in cult., and perhaps a hybrid of *P. baccata* and *P. Sieboldii*; intro. from Japan, where it seems not to be recognized, Rehder finding that what the Japanese botanists know under this name is *P. Halliana*: shrub or sometimes a small tree, often thorny: young growths glabrous or very soon becoming so: lvs. ovate and usually acuminate, the petioles rather thick and reddish and usually not much if any more than 1 in. long on the leading young shoots, the margins very sharply serrate or incised-serrate, not lobed, usually thickish, shining above and glabrous (or soon becoming so) beneath: fls. rose or rose-red, appearing with the lvs., produced in great abundance and very showy; styles nearly always 4, very rarely 3 or 5, connate to the middle: fr. usually about the size of a pea, on long, slender stalks, red, not persisting till winter. China. R.H. 1866:311; 1871:591; 1881, p. 296. F.S. 15:1585. G.F. 1:152; 2:523. A.G. 13:437; 18:437. F.E. 9:573. M.D.G. 1899:454.—The name of this species is somewhat in confusion. It has been known as *P. floribunda*, but Lindley earlier gave this name to a very different plant, of the section or genus *Aronia* (see p. 396, Vol. I), and the present species must take a new name. *P. pulcherrima* is one of the best of all early spring-flowering bushes or small trees, and is now common in gardens. The semi-double forms often improperly receive the names *Halliana* and *Parkmanii*. It makes a broad round-headed great bush, with handsome rose-colored buds and whitish expanded fls. *P. atrosanguinea*, Spaeth, is a handsome floriferous species of doubtful origin. It is probably *P. Halliana* \times *P. Sieboldii* (Koehne supposes it to be *P. Halliana* \times *P. fusca*): resembles in general *P. pulcherrima*, but differs in its deep carmine fls. not fading to white, rather narrower petals, shorter ovate and somewhat obtuse calyx-lobes, more shining and finally glabrous lvs., those lvs. at the end of vigorous shoots sometimes slightly 3-lobed: fr. dark red. Gt. 47:1448.

Var. *Scheideckeri*, Bailey (*Pyrus Scheideckeri*, Spaeth. *Malus Scheideckeri*, Zabel), originated at Scheidecker's nursery at Munich from seeds of *P. pulcherrima*, but shows evidences of hybridity with some closely related species (probably with *P. prunifolia*) or else indicating

the hybrid origin of *P. pulcherrima* itself: small tree of pyramidal habit, producing abundantly of large semi-double tinged pink fls.: young branchlets slightly pubescent: lvs. ovate, acuminate, about 3 in. long, scattered-pubescent beneath, petiole hairy, margins coarsely sharp-serrate or double-serrate: fr. globose, $\frac{3}{4}$ in. diam., the calyx usually persistent. Gng. 6:308. A.F. 13:1398. Gn. M. 10:20. G.M. 44:274; 54:861; 55:820; 57:256. G. 26:203; 27:234. Gn. W. 21: suppl. July 23. Gt. 53:1529 and p. 418.

Var. *Arnoldiana*, Bailey (*Malus floribunda* var. *Arnoldiana*, Rehd.). Originated at the Arnold Arboretum, Boston, as a seedling of *P. pulcherrima*: fls. more than one-half larger than in the type, pale rose: fr. much larger, yellow: of bushy habit.



3295. *Pyrus Sieboldii* ($\times \frac{1}{2}$). See No. 34.

AAA. The American native wild apples or crabs, sometimes planted in grounds but only *P. ioensis* yielding marked horticultural forms: fls. large, pink, fragrant: lvs. for the most part coarsely toothed and more or less lobed or notched: calyx persistent (exception in *P. fusca*). Not all these species are in cult. outside botanical collections, but they have been so much confused that it is necessary to describe all of them in order clearly to distinguish them.

B. Calyx deciduous from the fr.: western.

37. *fusca*, Raf. (*P. rivularis*, Douglas. *Malus rivularis*, Roem.). Shrub or small tree, sometimes 30-40 ft. tall, the young growths more or less pubescent: lvs. ovate-lanceolate, acute or acuminate, very sharply and strongly serrate, often 3-lobed or notched on the strong shoots, pubescent beneath: fls. white, on slender pubescent pedicels, appearing when the lvs. are nearly or quite full grown, nearly or fully 1 in. across: fr. oblong, $\frac{1}{2}$ in. or less long, yellow or greenish, the calyx-lobes caducous. N. Calif. to Alaska. S.S. 4:170.—Accord-

ing to Sargent, *P. fusca* "grows usually in deep, rich soil in the neighborhood of streams, often forming almost impenetrable thickets of considerable extent, and attains its greatest size in the valleys of Washington and Oregon." The fr. is eaten by Indians. Var. *lévipēs*, comb. nov. (*Málus fusca* var. *lévipēs*, Schneid. *M. rivularis* var. *lévipēs*, Koehne. *Pyrus rivularis* var. *lévipēs*, Nutt.), has glabrous infl. and outer surface of calyx. Var. *diversifolia*, comb. nov. (*Pyrus diversifolia*, Bong. *Málus fusca* var. *diversifolia*, Schneid. *M. rivularis* var. *diversifolia*, Koehne), has white-tomentose infl. and outer surface of calyx. *Málus Dawsoniana*, Rehd., is a supposed hybrid of *P. fusca* and *P. Malus* raised at the Arnold Arboretum and named for Jackson Dawson. In habit it is like *P. fusca*, but the lvs. are usually broader and more oval, more crenately serrate and rarely lobed: fls. and frs. nearly twice as large, the calyx persistent. S.T.S. 2:91.

BB. Calyx persistent: eastern.

C. Foliage glabrous at maturity.

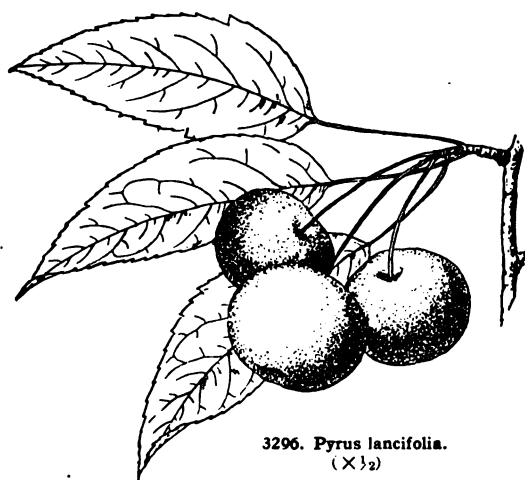
D. Apex of lvs. rounded and obtuse; margins crenate-serrate.

38. *angustifolia*, Ait. (*Málus coronaria*, Brit. *M. angustifolia*, Michx. *M. sempervirens*, Desf. *P. sempervirens*, Willd. *M. microcarpa* var. *sempervirens*, Wenz.). Small tree, to 20 or 30 ft.: lvs. lance-oblong, crenate-serrate or almost entire, not lobed or only slightly so, thick and partially evergreen, rounded at apex, cuneate at base: fls. 1 in. across, fragrant, in few-fl. umbels, slender-pedicelled; calyx-tube glabrous or pubescent outside, the lobes narrow-acuminate and with rigid points and tomentose inside; petals narrow-obovate, slender-clawed; styles tomentose below: fr. subglobose to slightly pyriform, $\frac{3}{4}$ –1 in. diam., with cavities at both ends, yellow-green and fragrant. Va. to Fla. and Miss. S.S. 4:169. B.R. 1207. A double-fl. form is sometimes described and figured as *P. angustifolia*, but it is properly *P. ioensis* (No. 44). Var. *pubérula*, Bailey (*M. coronaria* var. *pubérula*, Rehd. *M. angustifolia* var. *pubérula*, Rehd.), in Miss. and La., differs mostly in its pointed lvs., which are lightly pubescent beneath when young, and by the slightly villous pedicels.

DD. Apex of lvs. acute or acuminate.

E. Lvs. not lobed, or sometimes slightly so at end of vigorous shoots.

39. *platycarpa*, Bailey (*Málus platycarpa*, Rehd.). Small tree, to 20 ft., with spreading unarmed branches, young growths thin-tomentose but becoming glabrous:



3296. *Pyrus lancifolia*.
($\times \frac{1}{2}$)

lvs. ovate to elliptic, rounded at base, the apex rounded but with short acute point, sharply and mostly doubly serrate, those on vigorous shoots broad-ovate and usually with several pairs of very broad triangular lobes: fls. 3–6 in raceme-like umbels, about $\frac{1}{2}$ in. diam., on glabrous pedicels 1–1 $\frac{1}{2}$ in. long; calyx-tube obconic and glabrous, the lobes or sepals lanceolate-acuminate and longer than the tube and densely tomentose within though glabrous without; petals orbicular-ovate, usually dentate; styles 5, villous below the middle and connate for one-third their length: fr. depressed-globose with deep depressions at both ends, broader than long (2 in. diam.), with persistent calyx, sometimes used for preserves. N. C. to Ga. in fertile bottoms. S.T.S. 2:189.—Mostly closely related to *P. coronaria*, but easily distinguished from this as well as from other species by the broad and large lvs. which are rounded and abruptly acuminate at apex, and never lobed, and by its very large fr.



3297. *Pyrus glaucescens*. ($\times \frac{1}{4}$)

Var. *Hodpesii*, Bailey (*Málus coronaria* var. *Hodpesii*, Rehd. *M. platycarpa* var. *Hodpesii*, Rehd.). Differs in pubescent calyx, oval to elliptic lvs. only slightly or not at all lobed, and by the larger fr. Known only in cult.

40. *lancifolia*, Bailey (*Málus lancifolia*, Rehd.). Fig. 3296. Small tree, to 25 ft., with spreading spiny branches, the branchlets slightly pubescent or nearly glabrous: lvs. ovate-lanceolate to oblong-lanceolate, 1 $\frac{1}{2}$ –3 in. long, at the apex acute or short-acuminate, at the base rounded or broad-cuneate, either finely or coarsely serrate and frequently doubly serrate with the short teeth pointing forward, those on vigorous shoots ovate or oblong-ovate and often slightly lobed: fls. 3–6, in umbel-like racemes, white or rose, something over 1 in. across, on slender glabrous pedicels 1 in. or more long; calyx-tube obconic and on the outside glabrous, the lobes or sepals oblong-lanceolate and exceeding the tube and villous-tomentose within but glabrous without; petals oval, long-clawed; styles 5, densely villous below the middle: fr. subglobose, about 1 in. diam., on slender drooping pedicels, green and waxy. Pa. and Va. to Mo. S.T.S. 2:158 (a sprig of which is reduced in Fig. 3296).—Distinguished from *P. coronaria* (*P. angustifolia*) by the shape of the lvs., which are acuminate and less coriaceous, by the narrower and longer calyx-lobes, styles villous to middle, and by the different fr.

EE. Lvs. distinctly lobed, particularly on the strong shoots and sometimes on the flowering branchlets.

41. *glaucescens*, Bailey (*Málus glaucescens*, Rehd.). Fig. 3297–3299. Small tree or large shrub, with twiggy spiny head, the branchlets glabrous or at first slightly pubescent: lvs. triangular-ovate or ovate, 2–3 $\frac{1}{2}$ in. long, at the apex acute or short-acuminate or even rounded, at base truncate villous-tomentose when young but becoming glabrous, glaucescent beneath, more or less triangular-lobed, coarsely serrate with abruptly acuminate teeth, the lowest pair of veins arising some distance above the base of the blade; petioles slender, soon becoming glabrous: fls. white or pink, 5–7 in umbel-like racemes, appear when lvs. are nearly full-grown, on slender glabrous pedicels 1 in. or so long; calyx-tube thinly villous outside, the lobes oblong-

lanceolate-acuminate and densely tomentose within; petals oval, rounded at top, more or less gradually narrowed into a claw; styles slightly shorter than the stamens: fr. flattened and concave at both ends, broader than long, not angled, yellow and waxy at maturity, fragrant. N. Y., and southward in the Appalachian region to N. C.; early-flowering. S.T.S. 2:157. This species is often confused with the following, but is easily distinguished by its distinctly lobed crataegus-like lvs. whitish on their under side.

42. *coronaria*, Linn. (*Malus fragrans*, Rehd. *Malus coronaria*, Mill.). Closely related to *P. glaucescens*, but differing in less deeply lobed more elongated lvs. which are green and not glaucous beneath at maturity, glabrous calyx-tube, and the fr. being strongly ribbed at the deeply sunken apex. N. Y. to Ala. B.M. 2009. B.R. 651. S.S. 4:167 (all as *P. coronaria*). R.H. 1884, p. 104 (as *P. microcarpa coronaria*). Gn. 29, p. 395; 34, p. 206.—The fr., which is produced in abundance, was often buried by the early settlers for use in the spring, when its acerbity was largely extracted; and it was sometimes used for cider. It is also useful for jellies and preserves. The species was probably never intro. into cult. for its frs., although it has been long grown for ornament and under domestication the apples are often twice their natural size. Var. *elongata*, Bailey (*M. fragrans* var. *elongata*, Rehd. *M. coronaria* var. *elongata*, Rehd.). Lvs. narrow-triangular and distinctly incised-serrate or lobed. N. Y. to N. C. There is a form with semi-double fls. and one (var. *aucubaeifolia*, Bailey) with variegated lvs. An attractive species. For recent discussions of the nomenclature of this species and No. 38, see Jackson, G.C. III. 55, p. 294, and Rehder, M.D., 1914, pp. 260-61.

43. *glabrata*, Bailey (*Malus glabrata*, Rehd.). A southern representative of *P. glaucescens*, native from N. C. to Ala., distinguished by the lvs. light green and not glaucescent on the lower surface and rather thin, glabrous, deeply lobed, distinctly cordate at base, and the lowest pair of lateral veins springing from the very base of the blade: calyx-tube glabrous and purple;

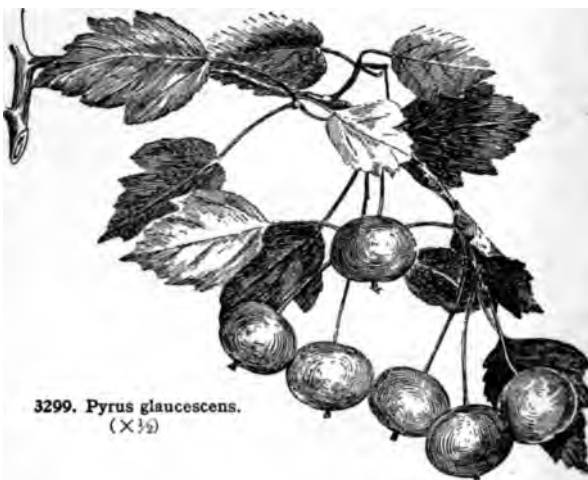


3298. A wild crab of the East.—*Pyrus glaucescens* (X 3/4). No. 42.

petals suborbicular or broadly ovate or rarely oval, abruptly contracted into a short claw, often erose-denticulate; styles 5, slightly longer than the stamens: fr. depressed-globose and slightly angled, distinctly ribbed at the deeply sunken apex. S.T.S. 2:188.

cc. *Foliage tomentose or villous or pubescent at maturity, at least on the vigorous shoots, the lvs. thickish and strongly veined.*

44. *ioënsis*, Bailey (*P. coronaria* var. *ioënsis*, Wood. *Malus ioënsis*, Brit. *Malus coronaria* var. *ioënsis*, Schneid. *P. iowënsis*, Carruth?). PRAIRIE or



3299. *Pyrus glaucescens*. (X 1/2)

WESTERN CRAB-APPLE. Fig. 3300. Small tree, the younger parts gray-woolly: lvs. from ovate-oblong to elliptic-obovate, irregularly and mostly bluntly toothed and the larger ones marked with right-angled notches of shallow lobes, very tomentose below or becoming rusty and rarely glabrate with age, the petioles short and stout and pubescent: fls. usually upon shorter pedicels which, like the calyx, are tomentose: fr. oblong or at least never flattened lengthwise, sometimes angular, larger than in *P. glaucescens* and clinging later to the tree, dull heavy green with numerous light-colored dots on the skin, the surface having a greasy feel, the st. short and thick as compared with No. 41, and set in an oblique cavity, the basin narrow and shallow, with variable corrugations and a closed and pubescent calyx, the flesh sour and austere. Wild in low or flat lands in the Mississippi Valley, the typical form, as understood by Rehder, ranging from Minn. and Wis. to Neb., Kans., and Mo. B.M. 8488. S.S. 4:168 (frs. too flat).—Frs. appropriated by the settlers, but the species is probably not in cult. for its fr., although a late-blooming double-fl. variety has been lately intro.,—Bechtel's crab, sometimes referred to *P. angustifolia*. G.C. III. 25:397. R.B. 38:185. R.H. 1910:60. *P. ioënsis* is a variable species, in some of its forms difficult to separate from *P. coronaria*, *P. angustifolia*, and other species. Var. *Palmeri*, Bailey (*M. ioënsis* var. *Palmeri*, Rehd.). Small and slender tree, to 18 ft., differing from the type chiefly in the smaller oblong more thinly pubescent lvs. which are rounded at apex, and those on the flowering shoots not lobed and crenate-serrate. Mo. Var. *spinosa*, Bailey (*M. ioënsis* var. *spinosa*, Rehd.). Dense bushy shrub, 6-8 ft., with slender spiny branches: differs from var. *Palmeri* in a shrubby habit, smaller lvs. and fls., and glabrescent calyx: from *P. coronaria* (*P. angustifolia*) in the pubescence of the lvs., serrate or serrulate lf.-margins and lobed ovate lvs. of the strong shoots. Mo. Var. *Bûshii*, Bailey (*M. ioënsis* var. *Bûshii*, Rehd.). Differs in bearing less deeply lobed lvs. than the type, which are glabrescent: from var. *Palmeri* it differs in having oblong-lanceolate acute glabrescent lvs. Mo. Var. *creniserata*, Bailey (*M. ioënsis* var. *creniserata*, Rehd.), is a slender spineless tree with branches villous when young, and crenate-serrate or entire elliptic-ovate to oblong-ovate lvs., or those on the vigorous shoots somewhat doubly serrate: calyx

tomentose. La. Var. *texana*, Bailey (*M. ioensis* var. *texana*, Rehd.). Small much-branched tree, to 18 ft., or sometimes a shrub forming thickets, with densely tomentose branchlets which become glabrescent the first or second year, differing from the type in having smaller and much broader lvs. that are not at all or only slightly lobed and densely villous at maturity. Texas, representing the southwestern extension of the species.

45. *bracteata*, Bailey (*Malus bracteata*, Rehd.). Tree, to 30 ft. or more tall, forming a broad head: a glabrescent form: lvs. elliptic-ovate to oblong-ovate, serrate or incisedly serrate and less deeply so than in *P. ioensis* and with less deep lobing, sometimes slightly lobed near the base, those on the vigorous shoots usually ovate and with recurved very short lobes on either side and the margins commonly only slightly serrate, the foliage glabrous or glabrescent except the slightly pubescent lvs. at the end of strong shoots: racemes 3-5-fl., the pedicels about $\frac{1}{2}$ in. long, glabrous or nearly so and bearing subulate bractlets $\frac{1}{4}$ - $\frac{1}{2}$ in. long which persist during flowering. Mo.

P. alnifolia, Franch. & Sav.=*Sorbus*.—*P. americana*, DC., and *P. aucuparia*, Ehrh.=*Sorbus*.—*P. arbutifolia*, Linn. f.=*Aronia*.—*P. Aria*, Ehrh.=*Sorbus*.—*P. Buxardii*, Hort., said to be a hybrid of which *Chaenomeles Maulei* is one parent, and therefore to be referred to that genus: described as having striking chamomise-red fls. of large size.—*P. cardinalis*, Hort.=*Chaenomeles japonica* var. *cardinalis*.—*P. Cydonia*, Linn.=*Cydonia*.—*P. domestica*, Ehrh.=*Sorbus*.—*P. florentina*, Sarg. (*Crataegus florentina*, Zucc. *Malus florentina*, Schneid. *Pyrus crataegifolia*, Savi. *Malus crataegifolia*, Koehne), considered by some writers to be of the *Malus* section, by others to belong to *Sorbus*, and by still others to be a hybrid between *Pyrus* and *Sorbus* (probably *Sorbus torminalis* \times *Pyrus Malus*) is a bush or small tree, local in N. Italy: lvs. broad-ovate in outline, with several sharp lobes: fls. white, about 1 in.

across, in open terminal corymbs, opening very late: fr. $\frac{1}{2}$ in. long, elliptic-oblong, red. B.M. 7423. G.C. III. 59:7.—*P. Fölgneri*, Lev.=*Sorbus*.—*P. germanica*, Hook. f.=*Mespilus*.—*P. Maulei*, Mast.=*Chaenomeles*.—*P. Maerlootsei*, Hort.=*Chaenomeles japonica* var.—*P. pinnatifida*, Ehrh.=*Sorbus*.—*P. spiria*, DC.=*Sorbus*.—*P. sambucifolia*, Cham. & Schlecht.=*Sorbus*.—*P. thianshanica*, Franch.=*Sorbus*.—*P. torminalis*, Ehrh.=*Sorbus*. L. H. B.

PYXIDANTHERA (Greek, a small box and anther; the anthers opening transversely like the lid of a box). *Diapensiaceae*. PYXIE. FLOWERING MOSS. PINE-BARREN BEAUTY. An evergreen creeping plant found in cushion-like masses in the sandy pine lands of N. J. to N. C. When it flowers in early April to early May, its white starry blossoms dot the light green or brownish green lf. and st. cushions. It grows best in moist sandy soil in the full sunlight and sometimes on gravel slopes of slight inclination. When growing amongst fallen lvs., its sts. become longer and the whole plant more open in character. The plant is rarely cult., although adapted to rock-gardens in sandy or gravelly pockets. Related to *Diapensia*, an alpine plant, and slightly to *Galax*. The only species is *P. barbulata*, Michx. An evergreen herb with depressed prostrate nearly glabrous sts., much branched at the base and creeping: lvs. numerous, blades leathery, linear-oblancoate, or linear-elliptic, imbricated, small, $\frac{1}{4}$ in. long: calyx campanulate, lobes 5, oblong, obtuse; corolla white, tube oblong-campanulate, petals 5, spatulate to obovate, spreading; anthers of 5 stamens yellow, opening transversely; ovary 3-celled: caps. 3-valved, few-seeded. B.M. 4592. Mn. 8:33. B.B. 2:583. Gn. 27, p. 209. G. 36:649. J.F. 2:150.

JOHN W. HARSHBERGER.



3300. Prairie States crab.—*Pyrus ioensis* ($\times \frac{1}{2}$). No. 44.

Q

QUAMASIA (quamash, the Indian name). *Liliaceae*.

A name given by Rafinesque in 1818 to the plants that Lindley, in 1832, called *Camassia*. On the principle of fifty years of accepted usage, the name *Camassia* is retained in the "nomina conservanda" of the International Botanical Congress (Vienna), and under that name the plants are treated in Vol. II. One species, variously known as *Camassia esculenta*, *Quamasia esculenta* and *Q. hyacinthina*, is native in the eastern United States, but the most showy species are from the Pacific side of the continent.

QUAMOCLIT (Greek, a dwarf kidney bean). Including *Calbda* and *Mina*. *Convolvulaceae*. Annual, or in tropical regions some perennial twining vines;

most of them of easy culture, of rapid growth, and with a profusion of small flowers.

The genus differs from all other *Convolvulaceae* by its axillary often 2-forked clusters of fls., the thickened pedicels of some species, the slender corolla-tube not expanding at the base, the limb of the corolla salverform or cup-shaped, stamens and style exserted and often declinate.—About 10 species. *Q. pinnata* is the best-known species, often used to advantage upon arbors, verandas, walls, or on screens in the conservatory.

A. Sepals without awns; pedicels thickened: lvs. pinnately divided.

pinnata, Bojer (*Ipomæa Quamoclit*, Linn. *Q. vulgaris*, Choisy. *Q. Quamoclit*, Brit.).

CYPRESS-VINE. INDIAN PINK. Fig. 3301. St. smooth, slender, twining to a height of 10–20 ft.: lvs. short-petioled or sessile: peduncles few-fld., commonly much longer than the petioles: corolla 1–1½ in. long, scarlet, the tube narrowly funnel-form, inflated above; the limb nearly flat, 5-lobed. July–Oct. Naturalized from Trop. Amer., Va. to Fla., west to Kans. and Texas; sparingly escaped from cult. farther north. B.M. 188 (as *Convolvulus Nil*); 244. Gn. 29, p. 33.—Beautiful in fl. and foliage but usually does not succeed well in the N. unless started early in the hot-house and transplanted. Var. *alba*, Hort., has white fls.



3301. *Quamoclit pinnata*. (×½)

AA. Sepals awned: lvs. entire or lobed.
B. Corolla-limb expanding abruptly from a slender tube, cup-shaped, ½ in. broad or broader.

coccinea, Moench (*Ipomæa coccinea*, Linn.). **STAR IPOMÆA.** Fig. 3302. St. freely twining for 10 ft.: lvs. slender-petioled, entire or angulate, acuminate: peduncle 2–6 in. long, few- to several-fld.; corolla ½–¾ in. wide, salverform; limb obscurely lobed, scarlet with yellow throat. Aug.–Oct. Apparently naturalized from Trop. Amer., on river banks in the Middle and South Atlantic states; probably indigenous to N. Mex. and Ariz. B.M. 221.—Fls. are produced in abundance, but are very small.

Var. *hederifolia*, House (*Ipomæa hederifolia*, Linn. *Ipomæa coccinea* var. *hederifolia*, Gray. *Mina sanguinea*, Hort.). Fig. 3303. This Plains form of the species has angulate, 3-lobed or even 3–5-parted lvs., and fls. usually larger. B.R. 9. B.M. 1769. I.H. 41, p. 159.—It is superior to the type for ornamental purposes.

Var. *lutæola*, House (*Ipomæa lutæola*, Jacq. *Ipomæa coccinea* var. *lutæa*, Hort.). Fls. yellow, an inch long. Varies to orange in color.

BB. Corolla-limb expanding funnel-form from a slender bent tube: lvs. 3-lobed.

C. Tube of corolla nearly 2 in. long, the limb 5-angled, scarlet.

grandiflora, Don (*Ipomæa Funis*, Cham. & Schlecht.). A perennial vine with cordate-hastate, 3-lobed lvs., finely pubescent: peduncles elongated, bearing 3–9 scarlet fls.: corolla about 2 in. long, slender, bent, expanding into a 5-angled limb less than an inch broad. S. Mex.

CC. Tube of corolla scarcely 1 in. long, yellowish, with a purplish, deeply 5-lobed limb.

vitifolia, Don (*Calbda vitifolia*, Cav.). A perennial twining glabrous vine: lvs. entire or 3-lobed, the middle lobe constricted below: peduncles elongated, several-fld.: corolla about 1 in. long, the yellowish tube expanding above into a scarlet, deeply 5-lobed limb, the exserted stamens elongated and declinate. S. Mex.

BBB. Corolla-limb cylindrical and bent, longer than the tube, yellow tinged with red.

lobata, House (*Mina lobata*, Llav. & Lex. *Q. Mina*, Don. *Ipomæa versicolor*, Meissn.). A vigorous perennial climber, 15–20 ft. high: lvs. with a cordate base, 3-lobed, the middle lobe longest and narrowed below: fls. ¼–¾ in. wide, opening rich crimson, soon fading to pale yellow. July–Sept. Mex. Gn. 30, pp. 436, 437; 39:144. R.H. 1887, p. 19. G.C. II. 26:684, 685. P.M. 16:100. V. 10:34, 35. B.R. 28:24. J.F. 4:400.



3302. *Quamoclit coccinea*. (×½)

—Distinguished from all other ipomœas by its bag-shaped corolla and scorpioid infl. It is a very free bloomer, and deservedly popular. H. D. HOUSE.

QUASSIA (from an aboriginal name). *Simarubaceæ*. Trees, sometimes cultivated in the greenhouse.

Leaves alternate, pinnate; lfts. alternate, entire, coriaceous: panicles axillary and terminal, elongated,



3303. *Quamoclit coccinea* var. *hederifolia*. (X 1/2)

branched; fls. subcymose-dioecious; calyx small, 5-lobed; petals 5; stamens 10 in the male, rudimentary in the female fls.; ovary sunken in the disk, deeply 5-parted: fr. 1-5 spreading sessile drupes.—About 5 species, Trop. Amer. and Trop. Afr.

amara, Linn. Shrubby tree: lvs. opposite, odd-pinnate, dark green with bright pink veins; lfts. 5, elliptical-oblong, pointed, entire, tapering toward the base, subsessile at the petiolar strictures; petiole articulate, winged: fls. crimson, in racemes; corollas never fully expanded, the petals having a spiral twist and curling round one another: drupes biglandular ovoid, black with a pale spot at the base. Trop. Amer. B.M. 497.—It furnishes the bitter quassia wood and its medicinal extract is used as a tonic. Now cult. in the tropics of both hemispheres.

F. TRACY HUBBARD.

QUEEN OF THE MEADOWS: *Filipendula Ulmaria*. Q. of the Prairie: *Filipendula rubra*.

QUEKETTIA (in honor of E. J. Quekett). *Orchidaceæ*. Small epiphytic plants: lvs. terete, fleshy: scape filiform, branched: fls. small; sepals and petals similar, linear; lip erect from foot of column, about as long as sepals, entire, hollowed at base; column erect, with 2 recurved appendages at apex; anther terminal, incumbent; pollinia 2, waxy, ovoid, upon linear stalks.—About 6 species known, all Brazilian. Related to *Ada*; little known horticulturally.

GEORGE V. NASH.

QUERCUS (ancient Latin name). *Fagaceæ*. OAK. Ornamental trees, rarely shrubs, grown chiefly for their handsome foliage and interesting habit; many species are important timber trees. See *Oak*.

Deciduous or evergreen trees, rarely shrubby: winter buds with usually many imbricate scales: lvs. alternate, short-petioled, with deciduous stipules, pinnately, serrate, lobed or pinnatifid, rarely entire: fls. monœcious; the staminate in slender, pendulous

catkins with 4-7-parted calyx and 4-12, usually 6, stamens; pistillate in 1- to many-fl. spikes in the axils of the young lvs., each fl. consisting of an incompletely 3-, or rarely 4-5-celled ovary, surrounded by imbricate bracts; style short or elongated, dilated above and stigmatic on the inner face: fr. a 1-seeded subglobose to oblong nut, surrounded at the base or sometimes almost inclosed by a cup-like involucre.—More than 200 species are known, distributed through the colder and temperate regions of the northern hemisphere and in the mountains of the tropics. The numerous species are usually divided into 3 subgenera. The species of the subgenus *Cyclobalanopsis* which has the scales of the cup connate into concentric rings are all Asiatic. The American species belong to *Lepidobalanus* (*balanus* is Greek for acorn) and to *Erythrobalanus*. In the former, comprising the white oak tribe, the acorns mature the first year (Fig. 3304). In the latter, comprising the black oaks, the acorns mature the second year (Fig. 3305). Besides the 200 species, about 40 hybrids have been recorded. *Passania*, often included under *Quercus*, is now usually considered a distinct genus, which see. The latest monograph of the whole genus is by A. DeCandolle in "Prodromus," vol. 16, 2, pp. 1-108 (1864-1868). Important illustrated works on American oaks are A. Michaux, "Histoire des Chênes de l'Amerique" (1801), with 36 plates; Kellogg and Greene, "Illustrations of West American Oaks" (1889), with 37 plates; Sargent, "Silva of North America," vol. 8 (1895), with 82 plates, and Liebmann, "Chênes de l'Amerique Tropicale" (1869), with 47 plates. Most of the European and west Asian oaks are figured in Kotschy "Eichen Europas und des Orients" (1862), with 40 colored plates. For comparative illustrations of lvs. see M.D. 1900, p. 32; R.B. 27, p. 61; G.W. 7, pp. 570, 571, 573; for those of frs. see M.D. 1900, p. 40; R.B. 27, p. 109.

The oaks are mostly trees, often tall with massive trunk and stout spreading limbs, with medium-sized, short-petioled leaves, usually more or less lobed, dentate or serrate, rarely entire, with inconspicuous flowers, the staminate ones in slender pendulous catkins and with fruits or "acorns" consisting of a globular to oblong nut inclosed at the base only, rarely wholly or nearly wholly, by a cup-like involucre. The oaks comprise some of the most important forest trees of the northern hemisphere.



3304. Annual-fruited oak—*Quercus alba*. The mature acorn is borne on the wood of the season. (X 1/4)

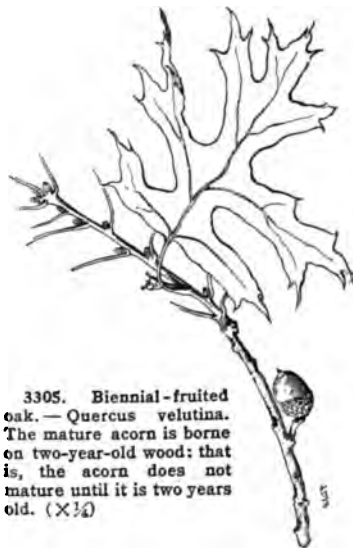
The wood of most species is strong, tough, hard and durable, and highly valued for many purposes, especially ship-building, construction, for furniture, and in the manufacture of wagons, tools and many other articles. The bark of some species, in America that of *Q. velutina* and *Q. prinus*, is used for tanning leather. Cork is obtained from the bark of *Q. suber* and *Q. occidentalis* in southern Europe. The bark of a few species has also been employed in medicine. The

acorns of several species are edible, in America especially those of *Q. prinus*, *Q. emoryi* and *Q. lobata*; in Europe those of *Q. ilex* var. *ballota* and *Q. ægilops*; in Japan those of *Q. glauca*; in many European countries the acorns of all species are an important food for hogs. In eastern Asia a silkworm feeds on the leaves of different species. A parasitic insect living on *Q. coccifera* in

southern Europe and northern Africa yields a scarlet dye. Galls caused by the puncture of certain insects are used for tanning and dyeing and are now chiefly obtained from *Q. Ilex* var. *infectoria* in western Asia. Some of the above-mentioned species are described only in the supplementary list, page 2890.

The deciduous species are mostly hardy North, while of the evergreen ones none seems to be hardy farther north than Washington, D.C.; some half-evergreen oaks, as *Q. Pseudoturneri* and *Q. macedonica*, will probably prove hardy in the vicinity of New York.

Most of the oaks are stately trees of noble and majestic



3305. Biennial-fruited oak. — *Quercus velutina*. The mature acorn is borne on two-year-old wood; that is, the acorn does not mature until it is two years old. (X 1/2)

habit with stout, wide-spreading branches; some, as *Q. alba*, *Q. Garryana*, *Q. virginiana*, and *Q. chrysolepis*, often cover a space more than 100 feet in diameter; others, as *Q. macrocarpa*, *Q. montana* and *Q. velutina*, have a more oval, round-topped head, while *Q. palustris* and *Q. imbricaria* form symmetrical broad pyramids. A very few hardy species are shrubs, generally called scrub oaks, as *Q. prinoides* and *Q. ilicifolia*. Oaks rank among our

most valuable park and avenue trees, and are as beautiful when grown as single trees as they are when grouped together and forming groves and woods. As avenue trees, *Q. palustris*, *Q. rubra*, *Q. coccinea*, *Q. imbricaria* and *Q. Phellos* are among the best, the last-named when medium-sized trees are desired; in the southern states, *Q. laurifolia*, *Q. nigra*, and the evergreen *Q. virginiana* are preferred. The shrubby species, like *Q. prinoides* and *Q. ilicifolia*, may be used for covering rocky hillsides and dry ridges.

Oak leaves are always beautiful. They have many shades of green; especially attractive are some with leaves of contrasting colors, the under side being silvery white, the upper one dark green, as in *Q. Muhlenbergii*, *Q. macrocarpa*, *Q. Prinus*, and some foreign evergreen species. In many oaks the leaves show a handsome pink or crimson color when unfolding, and some species assume brilliant autumnal tints. Especially beautiful in autumn are *Q. coccinea* and *Q. palustris*, with the foliage turning brilliant scarlet; *Q. rubra*, *Q. imbricaria*, and *Q. Prinus*, which turn bright or dark red; *Q. alba*, violet or vinous purple; *Q. lyrata*, scarlet or orange; *Q. Phellos*, pale yellow; *Q. montana*, orange or orange-brown; *Q. falcata* and *Q. ilicifolia*, orange-brown or yellow; *Q. stellata* and *Q. nigra*, brown or dull orange. Some of the foreign species, like *Q. sessiliflora* and also *Q. Robur*, *Q. Cerris*, *Q. lanuginosa*, *Q. glandulifera*, and others, retain the green color until late in fall. Besides our native evergreen species, the Japanese *Q. acuta*, *Q. myrsinaefolia*, and *Q. glauca* are among the best evergreen oaks for cultivation in the South; the European *Q. Ilex* and *Q. Suber* are also handsome evergreen trees.

Generally the oaks grow best in a moderately moist rich soil, including heavy clay; some, as *Q. bicolor*, *Q. nigra*, *Q. alba*, *Q. Phellos*, *Q. falcata*, and *Q. virginiana*, prefer moister situations and grow naturally in low and often even in swampy ground; while others,

especially the red oaks, like *Q. rubra*, *Q. coccinea*, *Q. imbricaria*, *Q. marilandica*, *Q. montana*, and *Q. stellata*, grow well in drier, rocky or sandy soil, and the scrub oaks on dry and barren soil. The black and red oaks, especially the pin oak, are usually easily transplanted and large trees are moved successfully, while the white oaks are more particular and only younger nursery-grown trees can be safely transplanted.

Oaks are propagated usually by seeds sown immediately after gathering in fall; this is especially necessary with *Q. alba*, *Q. virginiana*, and some other white oaks which sprout as soon as they are ripe; but only the root is produced in fall, while the stem does not appear until the following spring. The seeds of red and black oaks, and also of *Q. Robur*, if not sown at once should be stratified and sown early in spring. Acorns should be packed in earth, moss, or sawdust when shipped for a great distance. Varieties are usually grafted on potted stock in the greenhouse in early spring or sometimes in August. As a stock *Q. Robur* is preferred, but *Q. rubra*, *Q. velutina*, and *Q. montana* are also employed. It is probably safer to graft varieties of white and of red oak each on stock of the same group. The evergreen species are sometimes increased by layers and also by cuttings.

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KEY TO THE SPECIES.

- A. Scales of the cupula distinct, imbricate.
- B. Walls of nut tomentose on the inner surface: *lvs.* lobed, with bristle-tipped teeth and lobes or entire, bristly-pointed, but not serrate and not evergreen: *fr.* ripening the second year: bark dark-colored, not scaly. BLACK OAKS. (*Erythrobalanus*.)
- C. *Lvs.* pinnatifid, slender-stalked.
- D. Lobes of *lvs.* usually toothed: under side glabrous or rarely pubescent.

QUERCUS

- E. Longest lobe of the lf. about equaling the breadth of the broadish middle portion of the lf. 1. *rubra*
- EE. Longest lobes of the lf. 2-6 times as long as the narrow middle portion.
- F. Upper scales of cup closely appressed: lvs. glabrous: winter buds glabrous or puberulous.
- G. Cup brown, glabrous or puberulous and glabrate.
- H. Shape of cup flat, saucer-like: lvs. usually cuneate at base. 2. *palustris*
- HH. Shape of cup hemispherical or turbinate: lvs. usually nearly truncate. 3. *coccinea*
- GG. Cup grayish or pale brown, pubescent.
- H. Acorn about $\frac{3}{4}$ in. thick: cup $\frac{3}{4}$ -1 in. broad. 4. *Schneckii*
- HH. Acorn about $\frac{1}{2}$ in. thick: cup $\frac{1}{2}$ - $\frac{3}{4}$ in. broad. 5. *ellipsoidalis*
- FF. Upper scales of cup loosely imbricate.
- G. Winter buds puberulous or glabrous: acorn 1-1 $\frac{1}{2}$ in. long. 6. *Kelloggii*
- GG. Winter buds tomentose: acorn $\frac{1}{2}$ - $\frac{3}{4}$ in. long. 7. *velutina*
- DD. Lobes of lvs. entire or few-toothed: under side whitish or grayish tomentose.
- E. Plant a tree: lobes elongated, usually falcate.
- F. Under side of lvs. tawny or grayish pubescent. 8. *falcata*
- FF. Under side of lvs. white-tomentose. 9. *pagodæfolia*
- EE. Plant a shrub: lobes broadly triangular. 10. *ilicifolia*
- CC. Lvs. obovate, 3-5-lobed at the apex or almost entire, short-stalked.
- D. Shape of lvs. obovate-spatulate: lvs. glabrous. 11. *nigra*
- DD. Shape of lvs. broadly obovate: lvs. rusty pubescent beneath. 12. *marilandica*
- CCC. Lvs. oblong or linear-oblong, entire, rarely remotely toothed.
- D. Under side of lvs. glabrous.
- E. Lvs. lanceolate or linear-oblong, light green above, acute. 13. *Phellos*
- EE. Lvs. oblong, dark green above. 14. *laurifolia*
- DD. Under side of lvs. brownish pubescent. 15. *imbricaria*
- BB. Walls of nut glabrous on the inner surface (except Nos. 41, 42): lvs. sinuately lobed or toothed, not bristle-tipped, rarely serrate with bristly teeth; the evergreen lvs. sometimes entire: fr. ripening the first year (except Nos. 16, 37, 41, 42). WHITE OAKS. (*Lepidobalanus*.)
- C. Foliage deciduous.
- D. Lvs. sinuately dentate or serrate.
- E. Scales of cup linear or lanceolate, spreading and recurved.
- F. Margin of lvs. serrate: lvs. white-tomentose beneath. 16. *variabilis*
- FF. Margin of lvs. obtusely dentate, pubescent beneath. 17. *dentata*
- EE. Scales of cup appressed, imbricate.
- F. Petioles very short: lvs. usually auriculate at base, glabrous or nearly so beneath. 18. *mongolica*
- FF. Petioles rather slender: lvs. cuneate or rounded at the base.

QUERCUS

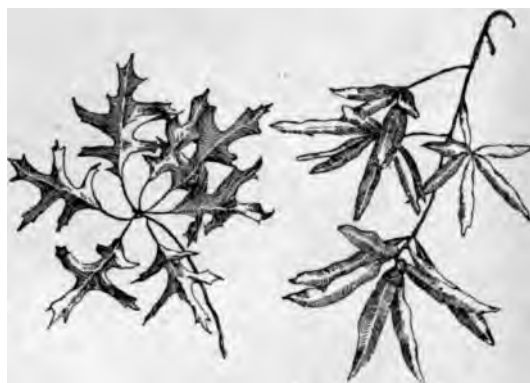
- G. Lobes of lvs. acute or acutish (sometimes obtusish in No. 20).
- H. Fr. peduncled: lvs. silky-pubescent beneath. 19. *glandulifera*
- HH. Fr. sessile or nearly so: lvs. tomentulose beneath.
- I. Teeth 7-15 on each side of lf.: trees.
- J. Petiole stout, $\frac{1}{4}$ - $\frac{3}{4}$ in. long; pairs of veins 10-15; base of lf. often rounded. 20. *aliena*
- JJ. Petiole slender, $\frac{1}{2}$ -1 in. long; pairs of veins 7-13; base of lf. cuneate. 21. *Muhlenbergii*
- II. Teeth 3-7 on each side: shrub. 22. *prinoides*
- GG. Lobes of lvs. rounded.
- H. Peduncle of fr. short or almost none.
- I. Under side of lvs. whitish or grayish tomentose. 23. *Prinus*
- II. Under side of lvs. pubescent or nearly glabrous, pale greenish. 24. *montana*
- HH. Peduncle much longer than petiole: lvs. tomentulose beneath. 25. *bicolor*
- DD. Lvs. pinnately lobed.
- E. Bark separating in thin scales, light gray or light brown. American species.
- F. Under side of lvs. pubescent or tomentose.
- G. Length of lvs. 5-8 in.: lvs. lyrate-pinnatifid.
- H. Cup fringed by awned scales. 26. *macrocarpa*
- HH. Cup not fringed.
- I. Fr. peduncled: lvs. white-tomentose beneath. 27. *lyrata*
- II. Fr. nearly sessile: lvs. pubescent beneath. 28. *stellata*
- GG. Length of lvs. 2-6 in.
- H. Upper surface of lvs. glabrous and lustrous. 29. *Garryana*
- HH. Upper surface of lvs. pubescent and dull: acorn elongated, to $2\frac{1}{4}$ in. long. 30. *lobata*
- FF. Under side of lvs. glabrous. 31. *alba*
- EE. Bark furrowed and ridged, not scaly, usually dark brown or dark gray. European species.
- F. Cup with imbricate, appressed scales.
- G. Lvs. glabrous below.
- H. Petioles shorter than peduncles. 32. *Robur*
- HH. Petioles longer than peduncles. 33. *sessiliflora*
- GG. Lvs. pubescent below.
- H. Scales of cup small, closely appressed: lvs. usually lobed. 34. *lanuginosa*
- HH. Scales oblong to lanceolate, loosely appressed: lvs. usually pinnatifid.
- I. Petiole $\frac{1}{4}$ - $\frac{3}{4}$ in. long: fr. nearly sessile. 35. *Toza*
- II. Petiole short: fr. stalked. 36. *conferta*

- FF. Cup with elongated, spreading and recurved scales... 37. *Corris*
 CC. Foliage evergreen, dentate or entire.
 D. Lvs. whitish, tomentose or tomentulose beneath: fr. ripening the first year.
 E. Margin of lvs. dentate, rarely entire.
 F. Bark of trunk corky..... 38. *Suber*
 FF. Bark of trunk smooth..... 39. *Ilex*
 EE. Margin of lvs. entire, shape elliptic to oblong..... 40. *virginiana*
 DD. Lvs. finally glabrous beneath.
 E. Under side of lvs. fulvous-tomentose during the first year..... 41. *chrysolepis*
 EE. Under side of lvs. glabrous or stellate-pubescent at first..... 42. *agrifolia*
 AA. Scales of cup connate into concentric rings: lvs. evergreen. (*Cyclobalanopsis*.)
 B. Lvs. toothed, glaucous or glaucescent beneath.
 C. Under side of lvs. silky, at least while young..... 43. *glauca*
 CC. Under side of lvs. glabrous..... 44. *myrsinaefolia*
 BB. Lvs. entire, dull green beneath..... 45. *acuta*

Subgenus ERYTHROBALANUS. Black Oaks.

1. *rubra*, Linn. Fig. 3306. Tree, to 80, occasionally 150 ft., with stout spreading branches forming a broad, round-topped, symmetrical head: lvs. divided about half way to the middle by wide sinuses into 7-9 triangular-ovate or ovate-oblong lobes, dull green above, light green and pubescent at first beneath, at length glabrous, 5-9 in. long: fr. short-stalked; acorn ovoid, 1 in. long, embraced only at the base by the $\frac{3}{4}$ -1-in.-broad cup. Nova Scotia to Fla., west to Minn. and Texas. S.S. 8:409, 410. Em. 1:168. F.S. 17:1812, 1813. H.W. 2, p. 84.—Beautiful oak of rapid growth, growing into a large majestic tree, with usually broad

2. *palustris*, Linn. PIN OAK. Fig. 3307. Tree, to 80, occasionally 120 ft., with rather short spreading branches, forming a symmetrical pyramidal head, becoming irregular and oblong in older trees: lvs. deeply pinnatifid, sometimes almost to the midrib; lobes 5-7, oblong or oblong-lanceolate, toothed, separated by wide sinuses, bright green above, light green



3307. *Quercus palustris* (on the left) and *Q. phellos*. ($\times \frac{1}{2}$)

beneath, with axillary tufts of hairs, 3-5 in. long: fr. short-stalked; acorn subglobose or ovoid, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, embraced about one-third or more by the cup. Mass., to Del., west to Wis. and Ark. S.S. 8:422, 423. Em. 1:167. A.G. 17:213. Gng. 3:129. Mn. 2:155; 6:27. F.E. 28:223. G.W. 5, p. 13.—Handsome trees, especially when young; often used for avenues; grows rapidly and prefers somewhat moist soil; foliage bright red in autumn. The tree is fibrous-rooted and transplants well. Hybrids of this with the preceding species and with *Q. phellos* have been observed in cult.

3. *coccinea*, Muench. SCARLET OAK. Figs. 3308, 3309. Tree, to 80 ft., with gradually spreading branches forming a round-topped rather open head: lvs. deeply divided by wide sinuses into 7-9 rather narrow, oblong or lanceolate, few-toothed lobes, bright green and glossy above, light green and glabrous beneath, 4-8 in. long: fr. short-stalked, ovoid to oblong-ovate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, embraced about one-half by the almost glabrous cup. Maine to Fla., west to Minn. and Mo. S.S. 8:412, 413. Em. 1:163.—Especially valuable for its brilliant scarlet fall coloring; grows well in dryish situations. Hybrids of this species with *Q. rubra* and *Q. velutina* have been found.

4. *Schneekii*, Brit. (*Q. texana*, Sarg., in part, not Buckl.). Fig. 3310. Tree, attaining 200 ft., with an oblong open head: lvs. almost like those of *Q. coccinea*, with axillary tufts of ferruginous hairs beneath, 3-8 in. long: fr. ovoid, $\frac{1}{2}$ -1 in. long, embraced about one-third by the deeply saucer-shaped cup. Ind. and Iowa to Texas and Fla. S.S. 8:411. G.F. 7:515, 517 (adapted in Fig. 3310).—Tall tree: much like *Q. coccinea* in foliage and like *Q. rubra* in fruit, but the cup somewhat deeper and smaller and pale grayish tomentose.—The *Q. texana*, Buckl., is a small tree of S. and W. Texas, with smaller, 2-4-in.-long, less deeply lobed lvs. and oblong nuts about $\frac{1}{2}$ in. long, with a hemispherical cup. B.T. 292. Probably not in cult.

5. *ellipsoidalis*, E. J. Hill. YELLOW OAK, or BLACK OAK. Tree, to 70 ft. with ascending branches forming an oblong head: bark gray, close and smooth, yellowish within: lvs. oval in outline, truncate or broadly cuneate at the base, with 5-7 oblong lobes coarsely toothed at the summit, glabrous, lustrous and bright green above, paler beneath with axillary tufts of hairs, 3-5 in. long: fr. short-stalked or nearly sessile; acorn ellipsoid to subglobose, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, inclosed about one-third or



3306. Leaves and acorns of various oaks. 1, *Q. phellos*; 2, *Q. alba*; 3, *Q. velutina*; 4, *Q. rubra*; 5, *Q. montana*; 6, *Q. macrocarpa*; 7, *Q. bicolor*.

round head, the foliage turning dark red in fall. Hybrids are known with the two following species, with *Q. velutina*, *Q. falcata*, *Q. phellos* and *Q. imbricaria*. Var. *ambigua*, Fern. (*Q. ambigua*, Michx. f., not HBK. *Q. borealis*, Michx. f. *Q. coccinea* var. *ambigua*, Gray). Cups deeper and somewhat turbinate; acorn usually smaller. The northern form. See also note under No. 8.

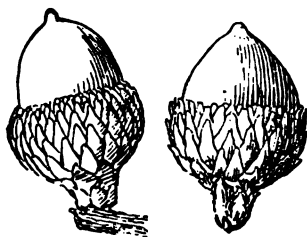
one-half by the turbinate or deeply saucer-shaped cup gradually narrowed at the base, with closely appressed, brown-pubescent scales. S. Mich. to Man. and Iowa. S.S. 14:771.

6. *Kéiloggii*, Newb. (*Q. californica*, Coop.). CALIFORNIAN BLACK OAK. Fig. 3311. Tree, occasionally to



100 ft., with stout spreading branches forming an open, round-topped head: lvs. divided about to the middle by wide sinuses into usually 7 oblong, toothed lobes, pubescent when young, at length glabrous and glossy above, yellowish green and glabrous or floccose beneath, 3-6 in. long: fr. short-stalked; acorn ovoid or oblong, mostly rounded at the top, 1-1½ in. long, embraced about one-third or one-half by the deep hemispherical glabrous cup. Ore. to Calif. S.S. 8:416. G.F. 9:145.

7. *velutina*, Lam. (*Q. tinctoria*, Bartram). BLACK OAK. YELLOW-BARK OAK. Figs. 3305, 3306, 3309. Tree, to 80, sometimes to 150 ft., with rather slender branches, spreading gradually into a narrow, open head: bark very dark brown, inner bark orange: lvs. pinnatifid to or beyond the middle, with 7-9 broad toothed lobes, dark and dull green above, brownish pubescent beneath at first, glabrous at length, except in the axils of the veins, 4-10 in. long: fr. short-stalked; acorn ovoid, ½-1 in. long, embraced about one-half by the hemispherical densely pubescent cup. Maine to Fla., west to Minn. and Texas. S.S. 8:414, 415. Em. 1:160. G.F. 5:55. —This species hybridizes with *Q. coccinea*, *Q. rubra*, *Q. imbricaria* and *Q. Phellos* (*Q. heterophylla*, Michx.).



3309. Acorns of *Quercus coccinea* (on left) and *Quercus velutina*. (Natural size.) Nos. 3 and 7.

8. *falcata*, Michx. (*Q. digitata*, Sudw. *Q. cuneata*, Auth., not Wang.). SPANISH OAK. Tree, to 70, rarely to 100 ft., with stout spreading branches forming an open, round-topped head: lvs. deeply pinnatifid, with 5-7 entire, acute and often falcate lobes gradually narrowed from a broad base and spreading at nearly right angles, separated by broad sinuses, drooping, dark

green and glabrous above, tawny or grayish pubescent beneath, 3-8 in. long: fr. short-stalked; acorn subglobose, ½ in. high, embraced one-half by the turbinate cup. N. J. to Fla., west to Mo. and Texas. S.S. 8:420. G.F. 8:104. F.E. 29:943. —Handsome, with peculiarly distinct foliage, but not quite hardy N. It appears that the original description of *Q. rubra*, Linn., applies to the Spanish oak (see Sargent in Rhodora 17:39); therefore, under a strict application of the rule of priority, *Q. falcata*, Michx., ought to be called *Q. rubra* and the tree heretofore known as *Q. rubra* ought to be known as *Q. borealis*, if var. *ambigua* is not considered specifically distinct; otherwise it ought to receive a new name. The name *Q. borealis* applies more strictly to the northern form (*Q. rubra* var. *ambigua*), while the more southern form becomes *Q. borealis* var. *maxima*, Sarg.

9. *pagodæfolia*, Ashe (*Q. falcata* var. *pagodæfolia*, Ell.). SWAMP SPANISH OAK. Tall tree, sometimes 120 ft. high, with wide-spreading branches forming a broad open head, but narrow in the forest; branchlets tomentose: lvs. deeply pinnatifid, with 5-11 entire, acute, spreading lobes narrowed from a broad base and often falcate, dark green and lustrous above, white-tomentose beneath, 5-8 in. long: fr. short-stalked or nearly sessile; acorn ovate to subglobose, little over ½ in. across, inclosed about one-half by the turbinate cup; scales loosely imbricate, pubescent except on the margin. Va. to Fla., west to S. Ill. and Ark. S.S. 14:772. —Handsome and valuable timber tree; about as hardy as the preceding species.

10. *ilicifolia*, Wang. (*Q. Bânisteri*, Michx. *Q. nana*, Sarg.). BEAR or SCRUB OAK. Intricately branched, spreading shrub to 10 ft. high, rarely small tree to 20 ft.: lvs. pinnately lobed, with usually 2 broad triangular lobes on each side, dark green and glabrous above,



whitish tomentulose beneath, 2-5 in. long: fr. short-stalked; acorn globose-ovoid, ½ in. or less high, embraced about one-half by the saucer-shaped cup. Maine to Va., west to Ohio and Ky. S.S. 8:424. Em. 1:170. —Growing naturally on dry rocky soil and forming dense thickets; it may be used for covering barren rocky ridges and hillsides. Hybrids with *Q. coccinea*, *Q. velutina*, *Q. marilandica*, and *Q. Phellos* are known.

11. *nigra*, Linn. (*Q. aquatica*, Walt. *Q. uliginosa*, Wang.). WATER OAK. Tree, to 80 ft., with rather

slender branches forming a conical, round-topped head: lvs. obovate, 3-lobed at the apex or sometimes entire, rarely pinnatifid above the middle, dull bluish green above, paler beneath, soon glabrous except axillary tufts of brown hairs beneath, $1\frac{1}{2}$ -3 in. long: fr. short-stalked; acorn globose-ovoid, $\frac{1}{4}$ - $\frac{3}{4}$ in. high, embraced one-fourth to one-third by the saucer-shaped cup. Del. to Fla., west to Ky. and Texas. S.S. 8:428.—Of rapid growth and easily transplanted; often planted as avenue tree in the S., but not quite hardy N. Usually called *Q. aquatica*.



3311. *Quercus Kelloggii*. ($\times \frac{1}{2}$)

12. *marilandica*, Muench (*Q. nigra*, Wang. *Q. ferruginea*, Michx.). BLACK JACK. JACK OAK. Tree, to 30, sometimes to 50 ft., with short spreading branches forming a narrow, round-topped or often irregular head: lvs. obovate, 3-5-lobed at the broad apex, with broad, entire or sparingly toothed lobes, glabrous and dark green above, at length glabrous and yellowish green beneath, brownish tomentose at first: fr. short-stalked; acorn ovoid-oblong, $\frac{3}{4}$ in. high, embraced one-third to two-thirds by the turbinate cup. N. Y. to Fla., west to Neb. and Texas. S.S. 8:426, 427.—There are hybrids with *Q. ilicifolia*, *Q. phellos*, and *Q. imbricaria*. Handsome tree, with large glossy foliage; hardy N. Better known as *Q. nigra*, but this name really belongs to the preceding species.

13. *phellos*, Linn. WILLOW OAK. Figs. 3306, 3307. Tree, to 50 ft., sometimes becoming 80 ft., with rather slender branches forming a conical, round-topped head: lvs. short-petioled, linear-oblong, bright green and glossy above, pubescent below when young, glabrous and light green at length, 2-4 in. long: frs. almost sessile, acorn subglobose, $\frac{1}{2}$ - $\frac{1}{2}$ in. high, embraced about one-fourth by the saucer-shaped cup. N. Y. to Fla., west to Mo. and Texas. S.S. 8:435. Gt. 29, p. 221. A.G. 17:195. F.E. 18:592 (pl. 87). R.H. 1898, p. 149.—Hybrids have been recorded with *Q. palustris*, *Q. rubra*, *Q. velutina*, *Q. ilicifolia* and *Q. marilandica*. Beautiful hardy medium-sized tree with handsome foliage turning pale yellow in fall; prefers moist or almost swampy soil.

14. *laurifolia*, Michx. LAUREL OAK. Tree, to 60, occasionally to 100 ft., with comparatively slender branches forming a dense, round-topped head: lvs. oblong or oblong-obovate, sometimes slightly lobed, acute or rarely obtusish, dark green and shining above, light green and puberulous at first, glabrous at length below, 2-6 in. long: fr. short-stalked; acorn ovoid or subglobose, about $\frac{1}{2}$ in. long, embraced one-fourth by the saucer-shaped cup. Va. to Fla. and La. S.S. 8:429, 430. F.E. 16:396 (pl. 62).—



3312. *Quercus lobata*. ($\times \frac{1}{2}$)

Handsome tree with almost half-evergreen glossy foliage, often planted as avenue tree in the southern and Gulf States; a particularly good form of this species is in the trade as "Darlington oak." Not hardy N.

15. *imbricaria*, Michx. SHINGLE OAK. Tree, to 60, rarely to 100 ft., with slender and somewhat pendulous branches, of pyramidal habit in its youth, round-topped when old: lvs. oblong or oblong-lanceolate, dark green and glabrous above, grayish tomentulose beneath, 3-7 in. long: fr. short-stalked; acorn subglobose, $\frac{1}{2}$ in. long, embraced one-third to one-half by the turbinate cup. Pa. to Ga., west to Neb. and Ark. S.S. 8:432. A.G. 17:195. Mn. 6:91.—Beautiful oak of symmetrical habit with handsome glossy foliage, turning russet-red in fall. There are hybrids of this species; with *Q. marilandica*, *Q. velutina*, *Q. rubra*, and *Q. palustris*, of which the last is in the trade as *Q. palustri-imbricaria*, Engelm.: it has oblong-lanceolate lvs. entire or coarsely

toothed, with bristly teeth, soon glabrous, 4-6 in. long: cup turbinate.

Subgenus LEPIDOBALANUS. White Oaks.

16. *variabilis*, Blume (*Q. chinensis*, Bunge, not Abel. *Q. Bungeana*, Forbes. *Q. serrata*, Carruth., not Thunb.). Tree, to 80 ft.: lvs. slender-petioled, oblong to oblong-lanceolate, acuminate, crenately serrate, with bristle-like teeth, dark green and glabrous above, whitish tomentulose below, $3\frac{1}{2}$ -6 in. long: fr. almost sessile; acorn subglobose, not much exceeding the large cup; scales thick, lanceolate, recurved. N. China, Japan. S.I.F. 1:28.—Handsome tree with distinct foliage almost like that of *Castanea crenata*; has proved hardy in Mass. and W. N. Y.

17. *dentata*, Thunb. (*Q. Dalmio*, Hort. *Q. obovata*, Bunge). Tree, to 80 ft., with broad, round-topped head: lvs. short-petioled, obovate, sinuately toothed, with 3-6 rounded broad teeth on each side, dark green



3313. White oak.—*Quercus alba* ($\times \frac{1}{4}$). No. 31.

and usually glabrous above at length, light green and pubescent beneath, firm and leathery, to 12 in. long: fr. almost sessile; acorn ovate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, embraced one-half by the large cup; scales lanceolate, thin, spreading and recurved. Japan, W. China. S.I.F. 1:27. F.E. 14:542 (pl. 29).—Remarkable for its large lvs., on young plants to 1 ft. long and 8 in. broad; hardy N. Var. *pinnatifida*, Matsum. (*Q. pinnatifida*, Franch. & Sav.). Lvs. divided almost to the midrib into linear lobes with crisp irregular margins; interesting form.

18. *mongolica*, Fisch. Tree, to 100 ft.: branchlets glabrous: lvs. on very short petioles less than $\frac{1}{4}$ in. long, obovate to obovate-oblong, obtuse at the apex, narrowed toward the rounded or auriculate base, coarsely toothed or sinuately lobed, with short and broad usually obtuse or obtusish teeth, dark green above and glabrous, paler green and glabrous beneath or pilose on the veins only, 4-8 in. long: fr. several or solitary on a short stalk or nearly sessile; acorn ovoid or ellipsoid, about $\frac{3}{4}$ in. long, embraced about one-third by the cup which is grayish tomentulose with thickened tuberculate scales, thinner and acuminate at the slightly fringed margin. E. Siberia, N. China, Korea, N. Japan. Var. *grosseserrata*, Rehd. & Wilson (*Q. grosseserrata*, Blume. *Q. crispula*, Blume). Lvs. somewhat smaller, usually acutish at the apex with acute or acutish sometimes denticulate teeth: cup with thin closely appressed scales, not fringed at the margin. Japan. S.I.F. 1:27.—Some Japanese botanists distinguish *Q. crispula* as a species by the hemispherical cup inclosing the acorn about one-half from *Q. grosseserrata* which has a saucer-shaped cup inclosing the acorn one-fourth or one-third, but many specimens are intermediate in this character, and, as the lvs. of the two forms are exactly alike, it seems hardly possible to distinguish these two

forms as varieties. Var. *grosseserrata* has proved perfectly hardy at the Arnold Arboretum and forms handsome trees of vigorous growth.

19. *glandulifera*, Blume. Tree, to 40 ft., rarely to 70 ft., shrubby in cult.: lvs. cuneate or rounded at the base, oblong-obovate to oblanceolate, acute with 7-12



3314. Staminate catkins.—*Quercus Robur* (× 1/2). No. 32.

some foliage, hardy at the Arnold Arboretum. Sometimes cult. under the name *Q. dentata*. *Q. glandulifera*, Mast., is *Q. Pseudoturneri* (see suppl. list).

20. *aliانا*, Blume. Tree, to 50 ft. or more: branchlets glabrous: lvs. oblong-obovate, obtuse or acutish at the apex, rounded or broadly cuneate at the base, coarsely sinuate-dentate with broad obtuse or acutish teeth, dark yellowish green and glabrous above, whitish or grayish tomentulose beneath, with 10-15 pairs of veins, 4-8 in. long; petioles 1/4-3/4 in. long: frs. 1-3, short-stalked or nearly sessile; acorn ellipsoid to oblong, 1/2-1 in. long, embraced about one-third by the cup-shaped grayish tomentulose cup, its scales thin, acuminate. S.I.F. 1:28. Japan, Korea, Cent. China. Var. *acuteserrata*, Maxim. Lvs. usually somewhat smaller and narrower, with acute or acutish gland-tipped teeth often slightly incurved at the apex. Japan, Cent. China.—This recently intro. species has proved hardy at the Arnold Arboretum.

21. *Muhlenbergii*, Engelm. (*Q. Castanea*, Willd., not Née. *Q. acuminata*, Sarg., not Roxbg. *Q. Prinus* var. *acuminata*, Michx.). YELLOW CHESTNUT OAK. Tree, to 100 or occasionally to 160 ft., with rather short branches, forming a narrow, round-topped head: lvs. slender-stalked, oblong to oblong-lanceolate, acute or acuminate, coarsely toothed with acute, glandular-tipped teeth, dark or yellowish green above, whitish tomentulose beneath, 4-7 in. long: fr. sessile or short-peduncled; acorns ovate, 1/4-3/4 in. long, embraced about one-half by the cup. Tenn. to Va., west to Neb. and Texas. S.S. 8:377.—Beautiful tree with light gray bark and handsome foliage, glossy above and silvery white beneath.



3315. English oak.—*Quercus Robur*. (Natural size). No. 32.

22. *prinoides*, Willd. (*Q. Chincapin*, Pursh. *Q. Prinus* var. *Chincapin*, Michx.). CHINCAPIN OAK. Spreading shrub, with slender sts., usually not over 6 ft. high, rarely to 15 ft.: lvs. rather short-petioled, cuneate at the base, ovate-oblong or oblong, with 4-8 sometimes obtusish teeth on each side, bright green above,

grayish tomentulose beneath, 2 1/2-5 in. long: fr. sessile, acorn oval, about 1/2 in. long, embraced one-half by the cup. Maine to Ala., west to Minn. and Texas. S.S. 8:378. Em. 1:158.—Pretty shrub for covering dry and rocky ridges. In trade sometimes under the misleading name of *Q. humilis*, for which see suppl. list.

23. *Prinus*, Linn. (*Q. Prinus* var. *palustris*, Michx. *Q. Michauxii*, Nutt.). BASKET OAK. COW OAK. Tree, to 100 ft., with round-topped, rather dense head: bark light gray, scaly: lvs. obovate or obovate-oblong, acute, deeply crenulate-toothed, with obtuse, mucronulate teeth, bright green and shining above, grayish tomentulose beneath, 4-7 in. long: fr. short-peduncled; acorn ovoid, 1-1 1/2 in. high, embraced about one-third by the tomentose cup. Del. to Fla., west to Ind. and Texas. S.S. 8:382, 383.—The *Q. Prinus* of most recent authors is the following species. One of the most beautiful of the chestnut oaks; prefers moist soil.

24. *montana*, Willd. (*Q. Prinus* var. *monticola*, Michx. *Q. Prinus*, Engelm., not Linn.). CHESTNUT OAK. ROCK CHESTNUT OAK. Fig. 3306. Tree, to 70, or occasionally to 100 ft., with broad, irregular head and dark brown, ridged bark: lvs. slender-stalked, obovate to oblong-lanceolate, coarsely crenulate-toothed, bright or yellowish green above, paler beneath, tomentulose when young, often almost glabrous at length, 5-8 in. long: fr. solitary or in pairs, on peduncles about 1 in. long; acorn ovoid, 1-1 1/2 in. high, embraced about one-third by the cup. Maine and Ont. to Ala. S.S. 8:375, 376. Em. 1:155 (as *Q. Castanea*) and 156. G.C. III. 14:617. G.F. 1:510.—Handsome oak, growing well in rather dry soil. A hybrid of this



3316. *Quercus Robur* var. *filicifolia* (× 1/2). No. 32.

species and *Q. Robur* is *Q. Sargentii*, Rehd., a tree of vigorous growth with handsome foliage, chiefly distinguished from *Q. montana* by the fewer lobes and the auriculate base of the lvs.

25. *bicolor*, Willd. (*Q. platanoides*, Sudw. *Q. Prinus* var. *tomentosa*, Michx. *Q. Prinus* var. *discolor*, Michx. f.). SWAMP WHITE OAK. Fig. 3306. Tree, to 70 ft., rarely to 100 ft., with narrow, round-topped, open head and light grayish brown, scaly bark: lvs. obovate to oblong-obovate, sinuately dentate, sometimes lobed half-way to the middle, dark green and dull above, whitish tomentulose beneath, 4-7 in. long: fr. solitary or in pairs, on peduncles 1 1/2-4 in. long; acorn ovate-

oblong, 1-1½ in. high, embraced one-third by the cup. Que. to Ga., west to Mich. and Ark. S.S. 8:380, 381. Em. 1:153. G.F. 4:246.—It is less desirable as an ornamental tree than many other species, but the wood is valuable. By the light gray bark separating in large thin scales and the numerous small branches which appear on the larger limbs and often on the trunk, it is easily distinguished from allied species.

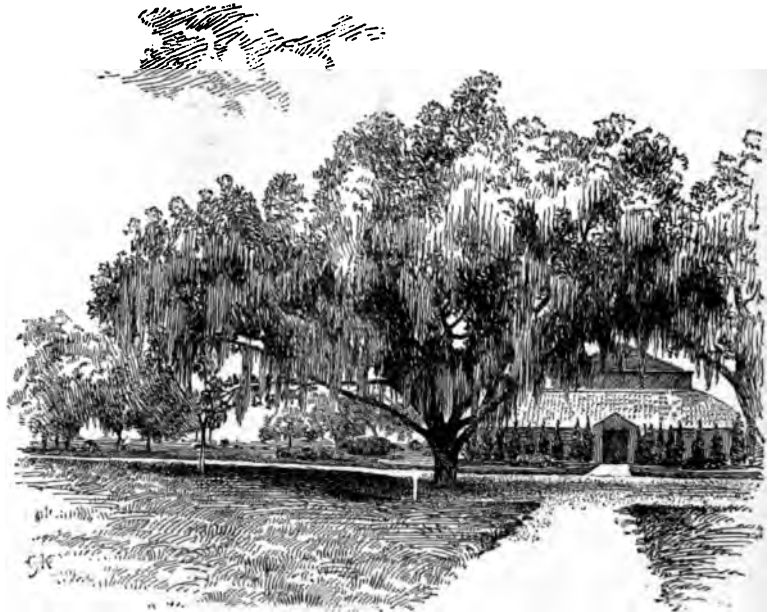
26. *macrocarpa*, Michx. BUR OAK. MOSSY CUP OAK. Fig. 3306. Tree, to 80, sometimes 160 ft., with large spreading branches, forming a broad, round head: bark light brown, deeply furrowed; younger branches sometimes with corky wings: lvs. obovate or oblong-obovate, lyrate-pinnatifid, with 4-10 pairs of lobes, the lower ones smaller, separated by wide and deep sinuses, the upper ones much larger, or sometimes the lvs. are only sinuately dentate above the middle, bright green and shining above, grayish or whitish tomentose beneath, 4-8 in. long: fr. sessile or short-stalked; acorn broadly ovate or ovoid, ¾-1½ in. high, embraced about one-half by the large ¾-2-in.-wide cup, with the upper scales awned and forming a fringe-like border. Nova Scotia to Pa., west to Man. and Texas. S.S. 8:371, 372. Em. 1:149. G.F. 2:500; 3:407. Mn. 2:153. Gng. 4:342. Var. *olivæformis*, Gray (*Q. olivæformis*, Michx.). Lvs. deeply pinnatifid, lobes almost all narrow and separated by wide sinuses: cup usually elongated, much higher than broad. S.S. 8:373. M.D.G. 1901:167.—The bur oak is of vigorous growth and becomes a stately tree and is of picturesque appearance in winter with its corky branches. The crown is often fan-shaped until tree is mature.

27. *lyrata*, Walt. OVERCUP OAK. SWAMP, or SWAMP POST OAK. Tree, to 100 ft., with rather small, often pendulous branches forming a symmetrical, round-topped head: lvs. obovate to obovate-oblong, deeply lyrate-pinnatifid, with 3-5 pairs of oblong or lanceolate lobes, the lower ones much smaller, separated by a wide sinus from the upper ones, dark green and shining above, whitish tomentulose beneath or sometimes light green and pubescent: fr. short-stalked; acorn globose, ½-1 in. high, almost entirely inclosed by the large scaly cup. N. J. to Fla., west to Mo. and Texas. S.S. 8:374. F.E. 17:736 (pl. 77).—Little cult.; hardy as far north as Mass.; prefers moist soil.

28. *stellata*, Wang. (*Q. obtusiloba*, Michx. *Q. minor*, Sarg.). POST OAK. Tree, to 60, rarely to 100 ft., with broad, dense, round head, and with grayish brown, deeply fissured bark: lvs. short-stalked, broadly obovate, lyrate-pinnatifid, with 2 or usually 3 pairs of lobes, the middle pair being much larger, undulate, and mostly with a lobe on the lower side, separated from the lower pair by wide, from the upper pair by narrower sinuses, dark green above, brownish tomentulose beneath, 5-8 in. long: fr. almost sessile; acorn ovoid, ¾ in. high, embraced one-third to one-half by the cup; scales lanceolate, loosely appressed. Mass. to Fla., west to Neb. and Texas. S.S. 8:368, 369. Em. 1:151.—Hardy and handsome tree with dense round head, growing naturally in rather dry, sandy or rocky soil; at the northern limit of its range, in S. Mass., it is usually shrubby.

29. *Garryana*, Douglas. OREGON OAK. Tree, to 80, rarely to 100 ft., with wide-spreading branches, sometimes shrubby: bark light gray: lvs. obovate, pinnatifid, with broad, obtuse, entire or toothed lobes, dark green above, pubescent and yellowish green or whitish below: fr. short-stalked; acorn ovoid, about 1 in. high, embraced about one-third by the saucer-shaped cup; scales usually thin. Wash. and Ore. to Calif. S.S. 8:364, 365. G.F. 7:495. F.E. 32:919.—The most important oak of the Pacific States as a timber tree.

30. *lobata*, Née (*Q. IIndsii*, Benth.). VALLEY or WEEPING OAK (WHITE OAK of the Pacific States).



3317. Live oak (*Quercus virginiana*) with Spanish moss hanging from the branches. Audubon Park, New Orleans. No. 40.

Fig. 3312. Tree, to 100 ft., with great, wide-spreading limbs and slender drooping branches: lvs. oblong or obovate-oblong, with 3-5 pairs of sometimes lobed-dentate lobes, dark green and stellate-pubescent above and usually whitish tomentulose beneath, 2-4 in. long: fr. almost sessile; acorn elongated, conical, 1½-2 in. high, embraced about one-third by the cup; lower scales tuberculate, upper one subulate. Calif. S.S. 8:362. G.F. 3:611; 10:55, 202, 205. C.L.A. 1:83.—Graceful wide-spreading tree; has not been cult. successfully outside of Calif.

31. *alba*, Linn. WHITE OAK. Figs. 3304, 3306, 3313. Tree, to 100 ft., with stout spreading branches forming a broad, open head: bark light gray: lvs. obovate or oblong-obovate, narrowed at the base, with 3-8 pairs of rather narrow obtuse and sometimes toothed lobes, pubescent when young, soon glabrous, bright green above, glaucescent beneath: fr. short- or long-stalked; acorn oblong-ovate, 1 in. high, embraced about one-fourth by the shallow cup; scales closely appressed. Maine to Fla., west to Minn. and Texas. S.S. 8:356, 357. Em. 1:145. G.F. 3:91; 4:6, 7; 5:259, 450. F.E. 20:650 (pl. 110); 32:489.—The white oak is one of the noblest trees of the northern states and a beautiful park tree, where space can be allowed for its full development; the foliage assumes a beautiful deep vinous red or violet-purple color in fall. Var. *repanda*, Michx., is a form in which the lvs. have rather shallow sinuses and the frs. are usually short-stalked. Var. *pinnatifida*, Michx., has the lvs. deeply pinnatifid with narrow often deeply toothed lobes and the frs. usually

slender-stalked. S.S. 8:358. Hybrids of this species with *Q. macrocarpa*, *Q. montana*, and *Q. stellata* are known. S.S. 8:359-61. The hybrid with *Q. montana* was found in the nursery of John Saul, near Washington, D. C., and has been distributed as Saul's oak (*Q. Saulii*, Schneid.).

32. *Röbur*, Linn. (*Q. pedunculata*, Ehrh. *Q. femina*, Mill. *Q. Röbur* var. *pedunculata*, DC.). ENGLISH OAK. Figs. 3314, 3315. Tree, to 120 ft., with stout spreading branches forming a broad round-topped head: lvs. short-petioled, auriculate at the base, oblong-obovate, with 3-7 rounded lobes on each side, quite glabrous, dark green above, pale bluish green beneath, $2\frac{1}{4}$ -5 in. long; fr. 1-7 on slender peduncles; acorn ovate or ovate-oblong, about 1 in. high, embraced about one-third by the hemispherical cup. Eu., N. Afr., W. Asia. G.C. III. 24:201; 25:168. F.S.R. 2, p. 196. G.W. 13, p. 566. H.W. 2:21, pp. 53-5. F.E. 21:100 (pl. 114).—More than 40 varieties are cult. in European nurseries and collections; some of the most important are the following: Var. *Concordia*, Schneid. (*Q. pedunculata Concordia*, Kirchn.). Lvs. bright yellow. I.H. 14:537. F.E. 13:1296 (pl. 19). Var. *contorta*, Hort. A form with twisted branches and crowded lvs. of irregular shape; of slow growth. Var. *fastigiata*, Schneid. (*Q. pedunculata fastigiata*, DC.). With upright branches forming a narrow columnar head. G.C. II. 19:179; III. 41:149. G.W. 15:663. F.E. 13:416 (pl. 3) (as var. *Lucombeana*). Of the same habit are var. *fastigiata cupressoides*, Hort., with narrower lvs. Var. *fastigiata atro-punctata* with yellowish spotted foliage. Var. *fastigiata viridis* with lvs. of darker green. Var. *heterophylla*, Rehd. (*Q. pedunculata heterophylla*, Loud. *Q. Röbur* var. *laciniata*, Schneid., var. *comp-tonizfolia*, Hort.), with narrow, elongated, slightly or crenately lobed, sometimes almost entire lvs. Var.



3318. Variation in the leaves of live oak.—*Quercus virginiana* (Nearly natural size). No. 40.

filicifolia, Schneid. (var. *asplenifolia*, var. *Doumettii*, Hort.). Fig. 3316. Lvs. deeply and irregularly divided often almost to the midrib in narrow linear lobes, with crisp margins. G.C. II. 14:632. I.H. 1, black fig., not numbered, opposite pl. 33. R.H. 1894, p. 17. Var. *pectinata*, Schneid. (*Q. Röbur* var. *pectinata*, Kirchn.). Lvs. regularly pinnately divided nearly to the midrib into linear lobes. Var. *pendula*, Schneid. (*Q. pedunculata pendula*, Loud.). With pendulous branches; a form with more slender and more decidedly weeping branches is var. *Dauvessae*, Hort. Var. *purpurascens*, DC. (*Q. pedunculata purpurascens*, DC., var. *purpurea*, Loud. *Q. Röbur sanguinea*, Schneid.). With the lvs. bright purple when young, becoming almost green at length, or as in the forms distinguished as var. *atropurpurea*, Schneid., and var. *nigra*, Hort., the color is more intense and retained through the whole summer. F.S. 17:1783, 1784. There are a number of variegated forms, but of no great ornamental value; the most often cult. are: *albo-variegata*, *argenteo-marginata*, *argenteo-picta*, *aureo-variegata*, *marmorata*, *joreauensis maculata*, *tricolor*.—Hybrids between this species and the following occur occasionally in Eu. (*Q. rosdacea*, Bechst. *Q. hybrida*, Bechst., not Brot.). For a hybrid with *Q. montana*, see No. 24.



3319. Acorn of live oak.—*Quercus virginiana*; often known as *Q. virens* (× $\frac{1}{2}$). No. 40.

33. *sessiliflora*, Salisb. (*Q. sessilis*, Ehrh. *Q. Röbur* var. *sessiliflora*, DC. *Q. Röbur*, Mill., not Linn.). Similar in habit to the former, but limbs less spreading and head less broad: petioles $\frac{1}{2}$ - $\frac{3}{4}$ in. long; lvs. rounded or cuneate at base, obovate or obovate-oblong, with 5-9 rounded lobes on each side, somewhat glossy above, pale and glabrous or slightly pubescent on the midrib beneath, $2\frac{1}{4}$ -5 in. long; fr. almost sessile, usually somewhat larger than those of the preceding species. Eu., W. Asia to Persia. H.W. 2:22, pp. 65-7. F.S.R. 3, p. 117. A very distinct variety is var. *mes-pillifolia*, Dipp. (var. *sublobata*, Koch), with almost entire lvs. H.W. 2, p. 65. Var. *laciniata*, Koehne. Lvs. deeply lobed with narrow lobes pointing forward. Gt. 61, p. 495. Var. *aurea*, DC. Lvs. yellow while young, changing later to green. Var. *purpurea*, Dipp. Young lvs. purple, changing to dark green. Var. *Louettei*, Kirchn. With pendulous branches and narrow slightly lobed or nearly entire lvs.—*Q. sessiliflora* is less common in cult. than the preceding species; both are usually called English oak and are sometimes considered varieties of one species.

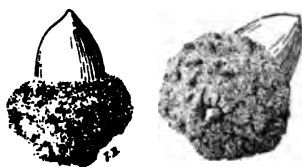
34. *lanuginosa*, Thuill. (*Q. pubescens*, Willd.). Tree, to 40 ft., but sometimes remaining shrubby: branches tomentose when young; lvs. pinnately lobed or pinnatifid, with 4-8 pairs of obtuse or acute lobes, glabrous above, pubescent or tomentose and grayish green beneath, 2-4 in. long; fr. almost sessile; acorn ovoid, $\frac{1}{2}$ -1 in. long, inclosed about one-half by the tomentose cup; scales closely appressed. Cent. and S. Eu., W. Asia. H.W. 2:23, pp. 69-71.—A very variable species, often shrubby, growing mostly on dry, rocky, and often on limestone soil; the more southern forms of it are tender. Var. *Hartwissiana*, Dipp. (*Q. Hartwissiana*, Hort.). Lvs. small, rather acutely lobed, yellowish tomentose beneath. Var. *pinnatifida*, Schneid. (*Q. pubescens* var. *pinnatifida*, A. Braun). Lvs. deeply lobed. Var. *crispata*, Beck, is similar but margin more crisp and under side more tomentose. Var. *pendula*, Jacq. (*Q. Agilops* var. *pendula* and *Q. Pseudagilops pendula*, Hort.), with pendulous branches

and densely tomentose lvs., resembles the following species and is supposed by some authors to be a hybrid between the two.

35. *Tôza*, Bosc (*Q. pyrendica*, Willd. *Q. camêta* and *Q. crinita*, Hort.). Tree, to 40 ft., with slender branches; branchlets yellowish tomentose; lvs. pinnatifid halfway to the middle or more, with rather narrow and acute lobes, pubescent above, yellowish or grayish tomentose beneath, 3-5 in. long; fr. short- or long-peduncled; acorn oblong, embraced one-third to one-half by the tomentose cup; scales loosely appressed, rather large. Spain, S. France. Var. *péndula*, Dipp., with pendulous branches.—Somewhat tender N.

36. *conférta*, Kit. (*Q. pannónica*, Hort. *Q. hungárica*, Hubeny). Tree, to 120 ft., with gradually spreading branches forming a round-topped, open head: bark rather light brown; lvs. very short-petioled, auriculate at the base, obovate, deeply pinnatifid, with 5-7 pairs of often toothed lobes, dark green and almost glabrous at length, pale and tomentose beneath, 4-7 in. long; fr. short-peduncled; acorn ovoid-oblong, embraced about one-third by the cup; scales rather large, loosely appressed. Italy, S. E. Eu. G.C. II. 5:85. F.E. 19:236 (pl. 99). H.W. 2:24, pp. 72, 73.—Handsome oak with dark green foliage; hardy in Mass., but seems not reliable farther north.

37. *Cérris*, Linn. TURKEY OAK. Tree, to 120 ft., with rather short spreading branches forming a broad pyramidal, at length often irregular open head: lvs. oblong or obovate-oblong, pinnatifid, with 3-8 pairs of entire or few-toothed lobes, dark green and somewhat rough above, grayish pubescent or almost glabrous beneath at length; fr. short-stalked, ripening the second year; acorn oblong-ovate, to 1½ in. long, embraced about one-half by the large mossy cup. S.E. Eu. W. Asia. Mn. 3:166. Gn. 27, pp. 476, 477. H.W. 2:25, pp. 74-6. G.W. 8, p. 181. F.E. 14:1264 (pl. 41).—Handsome oak with dark green foliage and of pyramidal habit when young, but not quite hardy N. Easily recognized even in winter by the slender subulate scales surrounding and exceeding the winter buds.



3320. *Quercus chrysolepis*. (×½)

Var. *austriaca*, Loud. Lvs. longer-petioled, less deeply lobed, or almost sinuately dentate with short, acute, entire lobes. For *Q. austriaca sempervirens*, see *Q. pseudoturerni* in suppl. list. Var. *laciniáta*, Loud. Lvs. deeply pinnatifid, often almost to the midrib divided into narrow oblong acute lobes. Var. *Ambrozyána*, Aschers. & Graebn. (*Q. Ambrozyána*, Simonkai). Lvs. half-evergreen, smaller, subcoriaceous, glabrous above, with bristly teeth; stipules smaller, caducous. Hungary.—There are hybrids with *Q. Suber*, for which see *Q. Lucombeana*, in suppl. list.

38. *Süber*, Linn. CORK OAK. Evergreen tree, to 50 ft., with broad round-topped head and thick, deeply furrowed, spongy, elastic bark: lvs. ovate to oblong, rounded or subcordate at the base, remotely serrate glabrous above, whitish tomentose or sometimes glabrescent beneath, 1-3 in. long; fr. short-stalked; acorn ovate or oblong-ovate, ½-1¼ in. high, embraced one-third to one-half by the cup; scales thick, usually with short and often recurved tips. S. Eu., N. Afr. H.W. 2, pp. 80, 81. G.W. 8, p. 182.—From this species cork is obtained; it is much cult. for this purpose in E. India and recently also in Calif., where it seems to thrive well. *Q. occidentális*, Gay, differs chiefly in the fr. ripening the second year, in the less persistent lvs., the old ones mostly falling in spring, in the shorter scales of the cup and in its greater hardness; its bark is not distinguished commercially from that of the true cork oak.

39. *flex*, Linn. HOLLY or HOLM OAK. Evergreen tree, to 60 ft., with large, round-topped head: bark not corky; lvs. very variable, ovate to lanceolate, remotely serrate or almost entire and with revolute margin, dark green above, yellowish or whitish tomentose or sometimes glabrescent beneath, 1-3 in. long; fr. 1-3, usually peduncled; acorn ovate, embraced about one-half by the cup; scales thin, appressed, rarely slightly spreading. S. Eu. M. D.G. 1898:275. H.W. 2:25, pp. 77-79. G.M. 54:895. Gn. 65, p. 320. Var. *Bal-lôta*, DC. (*Q. Ballôta*, Desf.). Lvs. smaller, orbicular or broadly ovate; the sweet acorn



3321. *Quercus agrifolia* (×¼). No. 42.

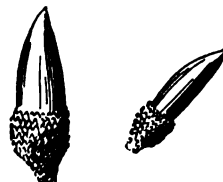
is often gathered for food. Var. *Fórdii*, Nichols. (*Q. Fórdii*, Carr.). Of pyramidal habit with narrower and smaller lvs. R.H. 1861, pp. 114, 115; 1885, pp. 352, 353. Not to be confounded with *Q. Fordiana*, Hemsl., a Chinese species with chestnut-like lvs.

40. *virginiana*, Mill. (*Q. virens*, Ait.). LIVE OAK. Figs. 3317-3319. Evergreen tree, to 50 or rarely to 70 ft., with almost horizontal limbs, forming a wide-spreading head; sometimes shrubby: lvs. elliptic or oblong, usually entire, with revolute margin, rarely with a few spiny teeth above the middle, dark green and glossy above, whitish tomentulose beneath, 1-3 in. long; fr. peduncled; acorn ovate, about 1 in. long, embraced about one-third by the cup; scales thin, appressed. Va. to Fla., west to Mex. S.S. 8:394, 395. G.F. 1:476; 5:486, 487; 6:7; 8:235. F.R. 1:643. Gng. 8:1. G.W. 9, p. 505.—One of the most beautiful of the American oaks and much planted as a shade and avenue tree in the southern states; easily transplanted and of rapid growth; also very valuable as a timber tree.

41. *chrysolepis*, Liebm. CALIFORNIA LIVE OAK. MAUL OAK. Fig. 3320. Evergreen tree, to 50, rarely to 100 ft., with wide-spreading head and often pendulous branches: lvs. short-petioled, oval to oblong-ovate, acute and spiny-toothed or entire, bluish or yellowish green above, glaucous beneath and covered with fulvous tomentum when young, 1-4 in. long; fr. short-stalked, ripening the second year; acorn ovoid, ½-1½ in. high, embraced about one-fourth by the shallow cup which is often very thick and densely fulvous-tomentose. Ore. to Calif. S.S. 8:398, 399. G.F. 5:127.—The most beautiful of the Californian oaks.

42. *agrifolia*, Née. Figs.

3321, 3322 (adapted from Pacific R. R. Report). Similar in habit to the former, sometimes shrubby: lvs. broadly oval to oblong, sinuately spiny-toothed, usually convex, dull green above, light green below, pubescent at first, 1½-3 in. long; fr. usually sessile; acorn conic-ovate, often elongated, to 1½ in. long, embraced one-fourth to one-third by the cup; scales thin, slightly puberulous. Calif. S.S. 8:403. F.S. 7, p. 138.



3322. *Quercus agrifolia*. (×½)

Subgenus CYCLOBALANOPSIS.

43. *glauca*, Thunb. (*Cyclobalanopsis glauca*, Oerst.). Evergreen tree, to 45 ft.: branchlets glabrous or nearly

so: lvs. on slender petioles $\frac{1}{2}$ -1 in. long, elliptic-oblong to ovate-oblong, acuminate, broadly cuneate or nearly rounded at the base, dentate above the middle, lustrous above, glaucous beneath and silky, at least while young, 3-5 in. long: fr. short-stalked, 1-3; cup saucer-shaped, silky-pubescent outside, with 5-7 concentric rings; nut ellipsoid, $\frac{1}{2}$ in. long. Japan. S.I.F. 1:30. I.T. 4:103.—Handsome evergreen tree, planted occasionally in Calif. and in the southeastern states.

44. *myrsinæfolia*, Blume (*Q. Vibrayana*, Franch. & Sav. *Q. bambusæfolia*, Fort., not Hance. *Cyclobalanopsis Vibrayana*, Schottky). Evergreen tree, to 50 ft.: lvs. lanceolate or oblong-lanceolate, acuminate, cuneate at the base, serrate, glaucescent and glabrous beneath from the beginning, shining green above, 3-5 in. long and $\frac{3}{4}$ -1 $\frac{1}{4}$ in. wide: fr. in short spikes; nut oblong-ovoid, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, embraced about one-third by the glabrous cup consisting of about 6 concentric rings. Japan. S.I.F. 1:29.—Beautiful evergreen oak for the southern states. In the American trade confused with *Q. acuta* and in European gardens with *Q. glauca*.

45. *acuta*, Thunb. (*Q. Buergeri*, Blume. *Cyclobalanopsis acuta*, Oerst.). Evergreen small tree: lvs. oblong-ovate to oblong-lanceolate, acuminate, rounded at the base, entire and usually undulate on the margin, glossy green above, yellowish green beneath, glabrous, only when unfolding covered with a brownish quickly disappearing floss, 3-5 in. long: fr. in nearly sessile clusters; nut ellipsoid-oblong, about $\frac{3}{4}$ in. long, embraced about one-fourth by the pubescent cup consisting of about 6 concentric rings. Japan, Korea. S.I.F. 1:32. Gn. 19, p. 285; 79, p. 388.—Handsome tree, rare in cult.

The species in the following list are not hardy North except when mentioned:

Q. aculeata, Carruthers—*Q. serrata*.—*Q. Agilops*, Linn. Evergreen tree, to 60 ft.: allied to *Q. Cerris*: lvs. lobed-dentate with acute sinuses, fulvous-tomentose at first: cup large, with spreading, flat, lanceolate scales, not much to one-half shorter than acorn. S. Italy, Greece.—*Q. Aisdon*, Koehne—*Q. Pseudoturmeri*.—*Q. ataiolia*, Poech. Evergreen shrub: lvs. orbicular or oval, dentate, shining above, yellow-tomentose beneath, 1-2 in. long: cup with recurved lanceolate bracts; acorn $1\frac{1}{2}$ in. long. Crete. Gn. 18, p. 486; 40, p. 95. A.G. 13:436.—*Q. aquiloides*, Rehd. & Wilson. Evergreen shrub or tree, to 30 ft.: branchlets pubescent: lvs. subsessile, elliptic or ovate-elliptic, auriculate, spiny-dentate or entire, lustrous above, yellowish brown-tomentose beneath, $1\frac{1}{4}$ -3 in. long: fr. several, peduncled; cup saucer-shaped; acorn ovoid, $\frac{1}{2}$ in. long. W. China. Var. *rufescens*, Rehd. & Wilson (*Q. Ilex* var. *rufescens*, Franch.). Lvs. with yellowish gray, looser pubescence, older lvs. sometimes glabrous: scales of cup thicker, more villous. W. China.—*Q. arkanensis*, Sarg. Allied to *Q. marilandica*. Tree, to 70 ft.: lvs. broadly ovate, cuneate, at maturity glabrous beneath except tufts in the axils, 2-3 $\frac{1}{2}$ in. long: cup shallow; nut broadly ovate, $\frac{1}{2}$ in. long. Ark. S.T.S. 2:152.—*Q. austriaca sempervirens*, Hort.—*Q. Pseudoturmeri*.—*Q. Boyntonii*, Beadle. Allied to *Q. stellata*. Shrub, 3-15 ft.: lvs. ovate with 3-5 small obtuse lobes above the middle or nearly entire, 2-3 $\frac{1}{2}$ in. long: cup turbinate; acorn about $\frac{1}{2}$ in. long. Ala.—*Q. brevifolia*, Sarg.—*Q. cinerea*.—*Q. castaneifolia*, C. A. Mey. Half-evergreen tree, to 70 ft.: lvs. oblong-lanceolate, serrate, tomentulose beneath, rarely almost glabrous, 4-6 in. long: cup with lanceolate recurved scales. W. Asia to N. Persia. G.W. 11, p. 199. Not or only half-hardy N.—*Q. Catesbii*, Michx. Tree, to 60 ft.: lvs. similar to those of *Q. cuneata*, but rufous-tomentose when young, glabrous at length, except axillary tufts beneath, very short-petioled: cup turbinate with the scales extending above the rim and down the inner surface. N. C. to Fla. and La. S.S. 8:417.—*Q. Chapmanii*, Sarg. (*Q. obtusiloba* var. *parvifolia*, Chapm.). Usually a shrub, rarely small tree; allied to *Q. stellata*: lvs. ovate-oblong and entire or slightly sinuately lobed toward the apex. S. C. to Fla. S.S. 8:370.—*Q. chinensis*, Abel. See *Q. sclerophylla*.—*Q. cinerea*, Michx. BLUE JACK. Small tree: allied to *Q. imbricaria*, but lvs. tomentulose beneath, smaller, elliptic to oblong-lanceolate, half-evergreen: cup saucer-shaped; acorn subglobose. N. C. to Fla. and Texas. S.S. 8:431.—*Q. cleistocarpa*, Seemen—*Psasiania cleistocarpa*, Schottky (P. Wilsonii, Schottky. *Q. Wilsonii*, Seemen). Evergreen tree, to 50 ft.: lvs. coriaceous, elliptic-oblong to oblong-lanceolate, acuminate, broadly cuneate at the base, lustrous above, covered beneath with a thin scaly grayish tomentum, becoming glabrescent, 2-6 in. long: fr. in short dense spikes, subglobose, about $\frac{1}{2}$ in. across, the cup nearly inclosing the acorn; scales adnate. Cent. and W. China.—*Q. coccifera*, Linn. Evergreen small tree or shrub: lvs. oval to oblong, spinose-dentate, almost glabrous, 1-2 in. long: cup with spreading or recurved rigid scales: maturation biennial. S. Eu. H.W. 2:25, p. 82.—*Q. cuspidata*, Thunb. See *Castanopsis* p. 2891.—*Q. densiflora*, Hook. & Arn.—*Psasiania densiflora*.—*Q. Douglasii*, Hook. & Arn. Tree, to 60 ft., with dense, round-topped head: allied to *Q. Garryana*, but lvs. bluish green, less deeply lobed, often only sinuately dentate. Calif. S.S. 8:386.—*Q. dumosa*, Nutt. Evergreen rigid shrub to 8 ft. or

occasionally tree to 30 ft.: lvs. oblong to ovate, entire or sinuately toothed, pubescent, grayish green, $\frac{3}{4}$ -2, rarely to 3 in. long: fr. usually solitary and sessile; acorn oval, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, embraced one-third to two-thirds by the cup. Very variable. Calif. S.S. 8:392.—*Q. Emoryi*, Torr. Evergreen tree, to 40 ft.: allied to *Q. chrysolepis*: lvs. usually cordate, oblong-lanceolate, spiny-toothed, soon almost glabrous, 1-2 $\frac{1}{2}$ in. long: acorn oblong, $\frac{1}{2}$ - $\frac{3}{4}$ in. high. Texas to Ariz. S.S. 8:397.—*Q. Engleriana*, Seemen (*Q. sutchuenensis*, Franch.). Evergreen tree, about 30 ft.: branchlets brown, soon glabrous: lvs. ovate-oblong, acuminate, rounded at the base, with few small spiny appressed teeth, sometimes entire, finally glabrous, 2 $\frac{1}{4}$ -5 in. long: fr. 1-3, short-stalked; acorn ovoid, scarcely $\frac{1}{2}$ in.; cup with thin glabrescent brown scales, cup-shaped. Cent. China.—*Q. Esculus*, Linn. A S. European form of *Q. sessiliflora*, with the lvs. pubescent when young and deeply pinnatifid: synonym of *Q. sessiliflora* var. *aurea*, DC.—*Q. Fábri*, Hance. Tree, to 80 ft.: branchlets pubescent: lvs. short-stalked, ovate to oblong, obtusish, sinuately lobed with 6-10 pairs of short rounded rarely acutish lobes, grayish tomentulose and reticulate beneath, 3-6 in. long: fr. short-stalked; acorn oblong-cylindric, $\frac{1}{2}$ in. long, cup glabrescent, brown. China.—*Q. Fargesii*, Franch.—*Q. oxyodon* var. *Fargesii*.—*Q. fruticosa*, Brot.—*Q. humilis*.—*Q. fulhamensis*, Hort. See *Q. Lucombeana*.—*Q. Gámbelii*, Nutt. Small tree or shrub, very variable: allied to *Q. alba*: lvs. smaller, pale or yellowish green and usually finely pubescent below: fr. smaller, sessile. Colo. to Utah and Mex. S.S. 8:366, 367. Gt. 44, p. 7.—*Q. georgiana*, Curtis. Shrub, 6-8 ft., rarely small tree: allied to *Q. palustris*: lvs. smaller, less deeply lobed and lobes mostly entire. Ga. S.S. 8:425. Hardy.—*Q. Gilliana*, Rehd. & Wilson. Evergreen small tree, to 20 ft. or scrubby: lvs. subsessile, oval, rounded at the spiny-pointed apex, subcordate or rounded at the base, spiny-toothed, quite glabrous at maturity, 1-2 in. long: fr. sessile, ripening the first year; acorn ovoid, $\frac{1}{2}$ in. long, inclosed nearly one-half by the hemispherical cup. W. China.—*Q. glabra*, Thunb.—*Psasiania glabra*.—*Q. Graminitia*, Linn.—*Q. Ilex*.—*Q. Haas*, Kotschy. Closely allied to *Q. pedunculata*: lvs. sparingly stellate-pubescent beneath, larger: fr. larger. E. Eu. W. Asia. Hardy.—*Q. Henryi*, Seemen—*Psasiania Henryi*, Schottky. Evergreen tree, to 60 ft.: lvs. slender-petioled, oblong-lanceolate, acuminate, lustrous above, covered beneath with a thin scaly tomentum, finally glabrescent, 4-8 in. long: fr. in stout spikes 4-7 in. long; acorn depressed-globose, $\frac{1}{2}$ in. across, embraced only at the base by the saucer-shaped cup. Cent. China.—*Q. heterophylla*, Michx. Supposed hybrid of *Q. Phellos* and *Q. velutina*: lvs. oblong, narrowed into the petiole, sinuately lobed or toothed or entire. S.S. 8:436.—*Q. humilis*, Walt.—*Q. cinerea*.—*Q. humilis*, Lam. Half-evergreen shrub, with oval, coarsely dentate lvs., grayish tomentose beneath: fr. almost sessile. Portugal. Sometimes *Q. prinoides* is sold under this name.—*Q. incana*, Roxb. Evergreen tree, to 60 ft.: allied to *Q. serrata*: lvs. oblong to ovate-lanceolate, acuminate, mucronate-serrate, with 14-20 pairs of veins, glossy above, whitish tomentose beneath, 3-6 in. long: fr. sessile; acorn about 1 in. long, at first almost inclosed by the campanulate, rather thin cup. Himalayas. Sometimes united with *Q. lanata*.—*Q. infectoria*, Oliver—*Q. lusitanica* var. *infectoria*.—*Q. insignis*, Mart. & Gal., the Mexican white oak, has been intro. recently by the U. S. Dept. Agric.: said to be best suited to a moist warm climate: a rapid-growing tree, erect, 75 ft., and making large branches 30-40 ft. from the ground: branchlets densely hairy: lvs. short-stalked, ovate-oblong, remotely serrate, hairy, on both sides, 6-9 in. long: fr. subsessile; cup $\frac{1}{2}$ in. across, fulvous-pubescent.—*Q. inversa*, Lindl.—*Psasiania thalassica*.—*Q. Kohnel*, Ambrosy (*Q. Pseudoturmeri*, Veitch Cat., not Schneid.). Probably *Q. Ilex* x *Q. sessiliflora*. Lvs. oblong-ovate, cuneate, very obtuse at the apex, with few short lobes, glabrous; midrib yellow, changing to dull red in fall. Garden origin.—*Q. landa*, Wall. Evergreen tree, to 80 ft.: allied to *Q. incana*: lvs. oblong-lanceolate, with 10-16 pairs of veins, remotely toothed, 4-8 in. long: fr. smaller, cup hemispherical. Himalayas.—*Q. lanuginosa*, Don—*Q. lanata*.—*Q. Ledna*, Nutt. Supposed hybrid of *Q. imbricaria* and *Q. velutina*: lvs. oblong or ovate-oblong, sinuately toothed or entire, rounded at the base. S.S. 8:434. Hardy.—*Q. Libani*, Oliver. Half-evergreen shrub or small tree: lvs. oblong-ovate, coarsely serrate, light green and at length almost glabrous beneath, 2-4 in. long: acorn almost wholly inclosed; scales little spreading. Asia Minor. R.H. 1872, p. 155; 1877, p. 173 (not p. 172, which is probably *Q. Agilops*). Gn. 1, p. 618.—*Q. Lucombeana*, Sweet. (*Q. Cerris* var. *Lucombeana*, Loud. *Q. Cerris* var. *superperennis*, DC.). Supposed hybrid of *Q. Cerris* and *Q. Suber*. Half-evergreen tree to 70 ft., with broad, round head: lvs. oval-ovate, coarsely serrate, tomentose beneath, 2-3 $\frac{1}{2}$ in. long: cup with subulate spreading scales. Probably of the same parentage as *Q. fulhamensis*, differing by symmetrical pyramidal habit and more corky bark. Gn. 27, pp. 476-8.—*Q. lusitanica*, Lam. Half-evergreen tree, sometimes shrub: lvs. oval to ovate-lanceolate, coarsely and deeply serrate, pubescent beneath, 1-2 in. long: cup with appressed scales, embracing one-half to one-third of the nut. S. Eu. Var. *infectoria*, DC., is more shrubby and has the lvs. less pubescent beneath.—*Q. macedonica*, DC. Evergreen tree or shrub: lvs. oval-oblong, serrate, light green and sparingly pubescent beneath, 1 $\frac{1}{2}$ -3 in. long: cup with the lower scales appressed, the middle ones spreading and the upper ones inverted, almost inclosing the nut. Macedonia, Albania.—*Q. macranthera*, Fisch. & Mey. Tree, to 50 ft.: allied to *Q. conferta*: lvs. larger and less deeply lobed, with 8-10 ovate lobes on each side, each lobe $\frac{1}{2}$ -1 in. long, sometimes with 1-3 teeth on its lower side, pale and densely soft-pubescent beneath, 4-7 in. long: fr. nearly sessile; acorn about 1 in. long, embraced nearly half by the cup covered with lanceolate pubescent scales. Caucasus to N. Persia. A handsome and hardy oak with large striking foliage.—*Q. macrolepis*, Kotschy. A variety of *Q. Agilops*, with larger, less deeply lobed lvs. and the scales of the cup large and strongly recurved. Crete.—*Q. Margaritella*, Ashe. Allied to *Q. stellata*. Shrub or small tree, to 30 ft.: lvs. ovate, with 3-5 rounded lobes, pale green or glau-

cus and pubescent on the veins beneath, $2\frac{1}{4}$ - $3\frac{1}{4}$ in. long; nut ovoid-oblong, $\frac{1}{2}$ in. long, one-half or less included in the cup. Va. to Fla. and Ala.—*Q. Mirbeckii*, Durand. Allied to *Q. lanuginosa*. Tree, to 100 ft.: branchlets glabrous or nearly so; lvs. ovate-oblong, with 9-12 short obtusish teeth on each side, pubescent beneath while young, 4-6 in. long; fr. 1-4 on a stalk $\frac{1}{4}$ -1 in. long. N. Afr. G.M. 56:139.—*Q. mongolica*, Hort., not Fisch.—*Q. lanuginosa*.—*Q. oblongifolia*, Torr. Evergreen small tree, to 30 ft., with spreading, often contorted branches: allied to *Q. undulata*. Lvs. ovate to obovate, entire or spiny-toothed, glabrous, bluish green, 1-3 in. long; cup embracing about one-third of the ovate nut. Ariz. to Mex. and W. Texas. S.S. 8:388. G.F. 1:140.—*Q. oxyodon*, Miq. Half-evergreen tree, about 30 ft.: lvs. oblong, acuminate, rounded or broadly cuneate at the base, serrate, veins prominent, close and numerous, glaucescent and silky beneath, $2\frac{1}{4}$ -7 in. long; fr. in short spikes; acorns ovoid, about $\frac{1}{2}$ in.; cup with concentric crenate rings, grayish tomentulose. Cent. China, Assam. Var. *Fargesii*, Rehd. & Wilson. Lvs. smaller: rings of cup entire.—*Q. phillyroides*, Gray. Evergreen tree or shrub, with broadly oval to oblong-oval lvs., crenately serrate, except at the base, glabrous, 1-2 $\frac{1}{2}$ in. long; cup with appressed scales, small. Japan. S.I.F. 1:31.—*Q. ponicica*, Koch. Tree or shrub: lvs. oblong-oval, serrate, glabrous, glaucescent beneath, 4-6 in. long; cup with ovate-lanceolate scales, inclosing about one-half of the nut. Asia Minor. Gt. 40, p. 510. Hardy.—*Q. Pseudosieberi*, Santi. Evergreen or half-evergreen tree, allied to *Q. Suber*: bark less corky: lvs. more deeply serrate, thinner and less tomentose beneath: cup with recurved scales. Italy, N. Afr. H.W. 2, p. 82.—*Q. Pseudoturineri*, Schneid. (*Q. Aizoon*, Koehne. *Q. Turneri*, Hort., not Willd. *Q. austriaca sempervirens*, Hort.). Probably hybrid of *Q. Ilex* and *Q. pedunculata*. Half-evergreen: lvs. oblong-obovate, acute, cuneate, with about 5 pairs of ascending acutish lobes, somewhat pubescent beneath, midrib yellow, 2-4 in. long; fr. long-stalked. Garden origin.—*Q. Pseudoturineri*, Veitch Cat.—*Q. Koehnei*.—*Q. pumila*, Walt. (*Q. Phellos* var. *pumila*, Michx. *Q. sericea*, Willd.). Half-evergreen spreading shrub, to 12 ft., similar to *Q. cinerea*: lvs. oblong to linear-oblong, entire or coarsely toothed, tomentulose beneath, glabrous at length; acorn subglobose, $\frac{1}{2}$ in. high; maturation annual. N. C. to Fla. S.S. 8:404.—*Q. Pyramis*, Kotschy. Variety of *Q. Egilops*, with the lvs. less deeply and very irregularly lobed; cup embracing one-third of the acorn, with the lower scales loosely appressed, the upper ones recurved. Asia Minor.—*Q. reticulata*, Humb. & Bonpl. Half-evergreen tree, to 30 ft., or shrub: lvs. oval or obovate, spiny-dentate toward the apex, bluish green, tomentose and reticulate beneath, 1-5 in. long; fr. in slender-stalked spikes; cup with appressed scales. Ariz. and New Mex. to Mex. S.S. 8:390.—*Q. rotunda*, Hort.—*Q. phillyroides*.—*Q. sclerophylla*, Hort., not Lindl. Sometimes *Q. Pseudoturineri* is cult. under this name. The true *Q. sclerophylla*, Lindl., belongs to *Castanopsis*, see *Q. sclerophylla*, below.—*Q. sericea*, Willd.—*Q. pumila*.—*Q. serrata*, Thunb. (*Q. acutissima*, Carruthers). Half-evergreen tree: lvs. obovate-oblong to oblong, acute, serrate, light green and glabrous below, 2-8 in. long; fr. sessile; cup with large, spreading and recurved scales, embracing two-thirds of the nut. Korea, Japan. S.I.F. 1:26.—*Q. Skinneri*, Benth. Tree, to 70 ft.: lvs. slender-stalked, ovate to ovate-lanceolate, sinuately serrate with bristly teeth, glabrous, 3-6 in. long; fr. sessile; acorn subglobose, large. S. Mex., Guatemala. G.C. 1841:116.—*Q. sutchuenensis*, Franch.—*Q. Engleriana*, *Q. thalassica*, Hance—*Pasania thalassica*.—*Q. Turneri*, Willd. Half-evergreen tree: lvs. oval to elliptic-ovate, rounded at base, with 6-8 pairs of lobes, pubescent at least on the midrib beneath, midrib pale green. Origin unknown.—*Q. Turneri*, Hort.—*Q. Pseudoturineri*.—*Q. undulata*, Torr. Small tree or shrub: allied to *Q. Douglasii*; with smaller, less deeply lobed, bluish green lvs. pubescent below, nut smaller. Colo. to Ariz. and Texas. S.S. 8:385.—*Q. Ungerii*, Kotschy. Variety of *Q. Egilops*: lvs. smaller, lobed; cup with recurved scales, not much shorter than acorn. Asia Minor.—*Q. Veneris*, Kern. Tree: branchlets pubescent: lvs. subcoriaceous, broadly oblong, with 6-8 pairs of small acutish teeth, pubescent beneath or nearly glabrous, $1\frac{1}{4}$ -3 in. long; fr. nearly sessile; acorn embraced one-half by the hemispherical cup. Cyprus.—*Q. Wilsonii*, Seemen—*Q. cleistocarpa*.—*Q. Wislizenii*, DC. Evergreen tree, to 80 ft.: allied to *Q. agrifolia*: lvs. ovate to oblong-lanceolate, sinuately dentate or entire, glabrous, yellowish green beneath, 1-5 in. long; acorn embraced about one-half by the cup. Colo. to Calif. and Texas. S.S. 8:406.

Note on Castanopsis. A recently concluded study of the Chinese oaks has enabled us to name these Chinese species of *Castanopsis* which had not yet been determined when the article on that genus was written, and has furthermore convinced us that several species usually referred to *Pasania* or *Quercus* must be included in *Castanopsis*.

The following species of *Castanopsis* are known to be in cult.: *C. cerasatricha*, Rehd. & Wilson. Tree, to 50 ft.: branchlets densely villous: lvs. oblong-lanceolate to ovate-lanceolate, acuminate, obscurely toothed above the middle or entire, brownish villous-tomentose beneath, 4-6 in. long; frs. in stout spikes to 8 in. long, $\frac{1}{4}$ -1 in. across, fulvous-tomentulose, with stout prickles $\frac{1}{4}$ - $\frac{1}{2}$ in. long and divided at the apex into several spreading spiny points; nuts 2-3, wholly inclosed. W. China.—*C. chrysophylla*, DC., see Vol. II, p. 682.—*C. cuspidata*, Schottky (*Quercus cuspidata*, Thunb. *Pasania cuspidata*, Oerst.). This species is already mentioned under *Pasania*, see p. 2479. The ovate pointed involucre is marked with 4 or 5 wavy concentric ridges of small tubercles and includes wholly the solitary nut. There are two varieties in cult.: var. *latifolia*, Rehd. & Wilson, with larger and broader lvs. to $4\frac{1}{2}$ in. long and to $2\frac{1}{2}$ in. broad; and var. *variegata*, Rehd. & Wilson, with small lvs. bordered by a broad, irregular, creamy white margin. G.C. II. 12:233.—*C. Fargesii*, Franch. Tree, to 100 ft.: branchlets glabrous: lvs. elliptic-oblong to lanceolate, acuminate, serrate above the middle, thinly and closely yellowish or grayish tomentulose

beneath, finally nearly glabrous, 2-5 in. long; frs. in stout spikes to 6 in. long, about $\frac{1}{2}$ in. across, with stout, often reflexed fascicled spines, about $\frac{1}{2}$ in. long; nut usually solitary, wholly inclosed. Cent. China.—*C. platyacantha*, Rehd. & Wilson. Tree, to 80 ft.: branchlets glabrous: lvs. ovate-oblong to elliptic-oblong, acuminate, slightly toothed above the middle or entire, covered beneath, except the glabrous midrib, with a close fulvous tomentum, becoming paler the second year, $2\frac{1}{4}$ -5 in. long; spikes short, 3-6 fruited; frs. about 1 in. across, grayish tomentulose, densely covered with short and stout fascicled prickles; nuts wholly inclosed, 1-3. W. China.—*C. sclerophylla*, Schottky (*Q. sclerophylla*, Lindl. *Q. chinensis*, Abel). Tree, to 60 ft.: lvs. oval to oblong-ovate or oblong, acuminate, serrate above the middle, glabrous, glaucescent beneath, $2\frac{1}{4}$ -6 in. long; frs. in dense spikes with the peduncle to 4 in. long; involucre ovoid, with close concentric ridges of small tubercles, not wholly inclosing the solitary nut. E. and Cent. China.

ALFRED REHDER.

QUESNELIA (in honor of M. Quesnel, French Consul at Cayenne). *Bromeliaceae*. Caulescent or acaulescent herbs: lvs. spiny, in dense tufts: scape erect, nodding or pendulous; infl. spicate; bracts membranous or coriaceous, obtuse or acuminate, entire or serrate; fls. sessile, perfect; sepals usually free; petals free, convolute; stamens 6, equaling or a little shorter than the petals.—About a dozen species, natives of Guiana and Brazil.

arvensis, Mez (*Billbergia Quesneliana*, Brongn. *Q. cayennensis*, Baker). Lvs. up to $2\frac{1}{2}$ ft. long, $1\frac{1}{4}$ in. wide, armed with stout upturned spines: spike dense, up to 8 in. long, many-fl., the bracts rounded at apex, usually entire; fls. up to 2 in. long; sepals webby below; petals blue above; stamens much shorter than petals. E. Brazil. B.H. 1882:46 (as *Q. rufa*). F.S. 10:1028. Gt. 1875:834.

GEORGE V. NASH.

QUILLAJA (from *Quillai*, the Chilean name, which comes from *quilean*, to wash: the bark of the tree contains saponin, an alkaline compound, which makes it useful as soap). *Rosaceae*. Glabrous evergreen treps, whose bark is sometimes saponaceous, occasionally grown in the greenhouse and hardy outdoors in the southern United States.

Leaves sparse, petioled, simple, thick-coriaceous, rather entire; stipules small, deciduous: peduncles axillary and terminal, 3-5-fl.: fls. polygamous-dioecious, rather large, tomentose, the lateral male, the central fertile; calyx leathery, persistent, lobes 5, broadly ovate, valvate; petals 5, small, sessile, spatulate; disk thick, fleshy, 5-lobed; stamens 10; carpels 5: follicles 5, oblong, obtuse, leathery, cohering at their base, many-seeded.—About 3 or 4 species, natives of S. Brazil, Chile, and Peru.

Saponaria, Molina. SOAP-BARK TREE. A large tree: lvs. $1\frac{1}{4}$ -2 in. long, ovate, shining, dentate, short-petioled: fls. white, about $\frac{3}{8}$ in. across, usually terminal, solitary, or in clusters of 3-5 on the same peduncle. Chile. B.M. 7568.—Cult. in S. Calif.

F. TRACY HUBBARD.†

QUINCE. The fruit and tree of one of the pome class, known as *Cydonia oblonga* (or sometimes as *Pyrus Cydonia*).

Few fruits play a more important part in ancient history than the quince, and yet there is hardly a fruit with equal or even poorer merit that in recent years has not received more attention. Scarcely a book is written on the quince and even practical mention of its merits, its culture, or its value is seldom made in the experiment station literature of America.

Perhaps this is due to the fact that the fruit can hardly be considered in the dessert class except when cooked; and yet it is said that in Persia and the near East it grows to such perfection that some varieties are esteemed when eaten raw.

The place of the quince in America seems to be a secondary one, to make marmalade, to preserve, to make jellies, and for flavoring purposes. The place of the tree among other fruits seems to be secondary also. It is seen most frequently in back yards and fence-corners and often in the lowest and dampest fruit land on the

farm. In a few cases, when its merits are recognized, it is given drier richer ground and cultivated with judicious care. Naturally, the quince is adapted to deep rich warm soils. The fertility of the soil should be strongly emphasized, as the root, instead of penetrating



3323. Flower of quince. It is borne on the wood of the season, not from an autumn fruit-bud. ($\times \frac{1}{2}$)

deeply, spreads out extensively and consequently is near the surface. It is slow-growing on any soil but responds very quickly to good fertility. On cold damp soils the fruit is inclined to be woody and it may possibly be for this reason that the quince is not more popular for preserving purposes. On the richer drier soils the quality is much improved. The idea is very prevalent that the tree is adapted to low ground. The lower grounds, generally speaking, are richer, but in this respect only may the trees be said to be adapted to it. Excessive moisture is harmful to the quince as to other fruits. Cultivation must be judicious. In many respects it should resemble that given the dwarf pear. The roots being near the surface, cultivation and especially plowing must be shallow. It is common practice to ridge well up to the trees not only to protect the roots

but to permit easy drainage; also the tree being very subject to fire blight, it does not permit of thorough cultivation with the consequent succulent wood-growth. Moderate cultivation in spring and early summer followed at once by a cover-crop or a good sod-mulch is considered good practice.

The quince tree is small, twisted and dwarf in its habit. It seldom reaches a height of more than 12 or 15 feet, although some grow higher. The larger number are much lower. Being dwarf in its habit, the quince tree can be planted as close as 13 to 15 feet in an orchard,



3324. Quince, showing method of bearing at end of contemporaneous shoots.

the latter distance being the more popular. Planted too close, it is forced upright, like other trees. The fruiting habit is distinct and peculiar, resembling no other orchard fruit, but is similar to the hickory and the walnut. The blossoms are produced on the current season's growth (Fig. 3323). A short growth starts from the terminal winter bud and on the end of this the flower and fruit are produced (Figs. 8324, 3325). There is no proper stem or peduncle to the fruit, but the quince sits close or sessile on a short leafy branch. The wood-growth is continued by an axillary bud of the previous season. This peculiar habit of growth gives the tree its crooked bunchy appearance. (Fig. 3326.)

Pruning should receive careful attention, otherwise the quince tree will soon become too thick and also more or less unshapely. When set in orchard, the young tree may be pruned to a short whip, as shown in Fig. 3327. The trunk is kept very short; some growers prefer to start the top as low as shown in Fig. 3328, but the former and probably still the prevailing practice is to grow a trunk like those seen in Fig. 3329. These longer trunks are convenient if one is to use the curculio catcher, as shown in Fig. 3330. The pruning consists in keeping the top open and well spread (Fig. 3328). To cause the top to spread and to keep it low and within bounds, more or less heading-in may be practised; but as the fruit-shoots spring from the ends of the branches, clipping-in of all the tree would remove practically all the fruit.

The questions of cultivation and fertilizers are largely inter-related. Thorough tillage makes available a large amount of plant-food, and consequently less fertilizer is necessary. However, too thorough cultivation and consequent succulent growth increases blight. The question of fertilizers comes down to one of producing moderate growth of a hardy resistant nature. This means that in cultivated orchards, heavy applications of nitrates or nitrogenous manures must be withheld. Phosphate and potash on the other hand can be



3325. The Orange or Apple quince. ($\times \frac{1}{4}$)

applied in quantity, especially on the lighter soils. The cover-crops will probably supply the necessary nitrogen. If growth is very slow, a light application of farmyard manure may be made. Lime and land-plaster can also be applied in quantity.

The fruit is sold in eleven-quart baskets, bushels, and barrels, and ranges from 75 cents to \$1.25 a bushel, depending on the market and the demand. In Ontario the demand is very limited and there are scarcely any orchards on a commercial basis. In the eastern states and especially New York State, there are some orchards of considerable size (Fig. 3329). The fruit, though apparently hard and long-keeping, is comparatively easily bruised or marked and must be handled with care.

The trees begin to bear a few fruits the second and third years after planting but can not generally be said to bear a profitable crop until ten to twelve years of age. The fruit is very subject to limb-rub and disease, and must be carefully grown to look well. The ordinary

practice is to spray the tree with dormant-strength lime-sulfur at the same time that the apples and peaches are sprayed and then again just after the fruit is nicely set with bordeaux mixture, to each forty gallons of which has been added three pounds of lead arsenate. Summer-strength lime-sulfur with the above amount of poison would give the same results for the summer spray. Judicious pruning also tends to thin the fruit and improve the quality.

Seedling stocks—Quince of Angers—are largely imported from Europe for

roots. These roots are used also for dwarfing the pear. The trees are grown much the same as other nursery trees. The seedlings are set in the nursery row in early spring and budded in August. By a year from the following spring, that is two years from the setting of the seedling, the trees are ready for the planter. The quince can also be propagated by cuttings, mound-layering and root-grafting, but the above-named method is the common one in practice.

Trees received from the nursery should be given the same care as other nursery trees. Heel them in carefully if the soil is not ready for planting. Plant about 2 inches deeper than the bud. Head at 15 to 20 inches. If budded trees are used and planted the proper depth, there is little or no danger from suckering.

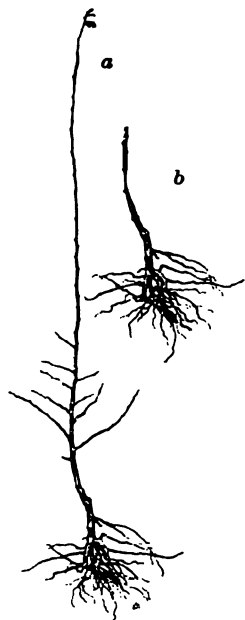
The most damaging diseases are fire-blight, affecting the wood and especially the new growth; leaf-blight, affecting branches, fruit and foliage; and black-rot and bitter-rot, affecting the fruit. For the fire-blight, the worst disease, there is no direct remedy, but trees should not be allowed to over-grow, wild hawthorns and wild apples and pears near the plantation should be destroyed, and all affected parts should be removed promptly.

The most serious insect attacking the quince is the quince curculio (*Conotrachelus crataegi*). This may be controlled by spraying with six to eight pounds of lead arsenate to one hundred gallons of water, or in the place of

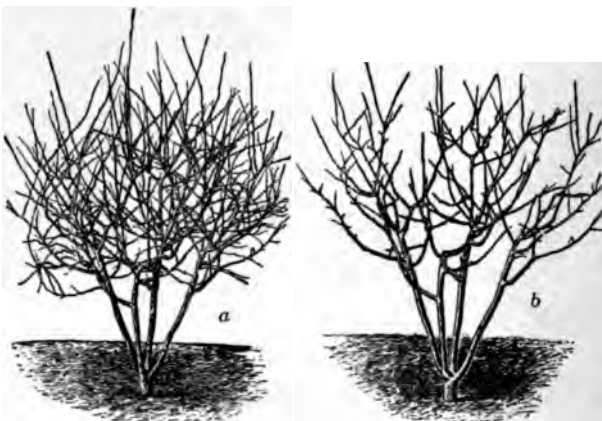
water bordeaux mixture at the proper season. This must be done when the beetles first make their appearance and again about ten days later. This insect is found on the quince in Ontario. The same insects as attack the apple generally attack the quince and the treatments are similar. Sometimes the jarring method



3326. Quince limb, showing branching and fruiting habit.



3327. a, An unpruned quince tree, one year old; b, the same pruned.



3328. a, The quince unpruned; b, same tree pruned.

is employed, as shown in Fig. 3330, as for the plum, the beetles being knocked off by hitting the tree with a padded mallet.

Orange (Fig. 3325) and Champion are the leading varieties of quince. The former is the variety most largely grown in Ontario and previous to 1870 was the only variety. It is large in size, skin golden yellow with greenish or russet color around stem. The flesh is tender and the flavor good. The season is late September and October. Its origin was southern Europe. The latter variety, of American origin, is large, pear-shaped and on the tree has a distinctly greenish yellow color. The tree is larger and taller-growing than Orange. The fruit is very late ripening. Other commonly grown varieties are Bentley, Fuller, Rea, Meech, and Van Deman.

F. M. CLEMENT.

QUISQUALIS (Latin, *who, what kind*). *Combretaceae*. Rambling subscandent large shrubs, including the rangoon creeper which is hardy in the extreme south



3329. New York quince plantation.

of the United States and is also sometimes grown in the warmhouse.

Leaves opposite, oblong or obovate, acuminate, entire; fls. in short spikes, axillary and terminal, white or red; calyx-tube prolonged, long and slender above the ovary, deciduous; petals 5; stamens 10, short; ovary 1-celled; fr. dry, coriaceous, 5-angled or 5-winged,

1-seeded.—About 4 species, chiefly Indian, 1 in Trop. and S. Afr. The name *quisqualis* means literally *who?* *what?* and is said to have been given by Rumphius in astonishment at the plant's behavior, for it is said to grow erect and shrub-like to a height of 3 ft., when it throws out from the base a new growth that climbs up the neighboring trees, after which the original shrub perishes. Many other interesting statements about this plant are made in B.M. 2033.

Quisqualis indica is cultivated in northern hothouses. For best results it should be planted in beds of soil composed of fibrous loam, peat, and sand. The flowers appear from June to September, and last well when cut. After flowering the plant should be cut back severely and water applied less frequently until the wood is

ripened. New growth starts the following spring. If the plant is kept in a very hot and humid atmosphere, it makes a rampant growth. It is remarkably free from insect pests and fungous diseases. Propagation is by softwood cuttings inserted in sand with bottom heat. (Emil Mische.)

indica, Linn. (*Celastrus nutans*, Hort. Reasoner, not Roxbg.). RANGOON CREEPER. Lvs. 4 in. long, nearly glabrous; calyx-tube extremely long (2-3 in.), slender, green; calyx-teeth triangular, acute, not acuminate; petals rose or scarlet; fr. with very sharp angles but hardly winged. Malaya. Widely cult. in tropics. B.M. 2033. B.R. 492. R.H. 1868:50 (as *Q. pubescens*).

F. TRACY HUBBARD.†



3330. Catching the curculio in a New York quince orchard.

R

RADERMACHIA (after J. C. M. Radermacher, 1757-83, a Dutch resident of Java, published a list of Javanese plants). Also spelled *Radermachera*. *Bignoniaceae*. Ornamental trees.

Plants with large opposite, pinnate or bipinnate lvs. and large fls. in terminal panicles: calyx campanulate, truncate or dentate; corolla campanulate, with 4 or 5 included stamens: caps. linear, loculicidal; septum thick, spongy with the seeds in shallow impressions.—Only two species seem to be in cult.; they can be grown in subtropical regions only, and are prop. by seeds, also by air-layering and by cuttings.—Species 8, in S. E. Asia.

R. sinica seems to revel in the light sandy soil of the Florida gardens. Its abundant, large, fern-like, crimped bipinnate foliage and its luxuriant symmetrical growth combine to make it an object of great beauty. It grows to a height of 10 to 12 feet in one season, and if not cut down by a severe freeze it attains a height of 20 feet in two years, provided the soil is made rich by a good fertilizer. Planted out in a conservatory in the North it soon reaches stately dimensions. It is easily raised from cuttings placed in sand. (H. Nehrling.)

pentandra, Hemsl. (*Orizyllum flavum*, Rehd.). Evergreen tree, to 20 ft., glabrous: lvs. bipinnate, with the stout petiole 2-3 ft. long; lfts. oblong to oblong-lanceolate, entire, 3-7 in. long; panicle about 1 ft. long; calyx with 5 short teeth, splitting; corolla yellow; tube 2 in. long; limb spreading, about 3 in. across; stamens 5: caps. linear-cylindric, to 3 ft. long. Spring. S. W. China. H. I. 2728. S.T.S. 1:92.—Hand-

some tree with bold foliage and showy yellow fls. exhaling a heavy rather disagreeable odor; intro. by the Arnold Arboretum, and flowered in the greenhouse in 1903.

sinica, Hemsl. (*Stereospermum sinicum*, Hance). Evergreen tree: lvs. bipinnate; pinnæ 8, each with about 7 stalked, ovate-lanceolate entire lfts. obtusely acuminate, glabrous, about 2 in. long; panicle large, terminal; calyx campanulate, with 5 short triangular teeth; corolla pale sulfur-yellow, with funnelliform tube about 3 in. long and spreading roundish lobes about 1 in. long with crisped margin: caps. subterete, 16 in. long and ¼ in. thick. S. E. China.

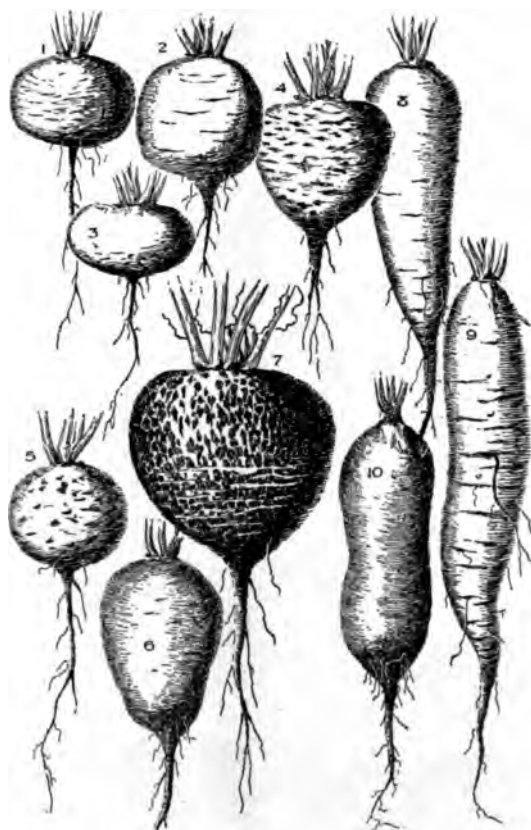
ALFRED REHDER.

RADÍCULA (little radish or root). Syn., *Roripa*, *Nasturtium*. *Cruciferae*. Herbs, not cultivated except water-cress, horse-radish, and one or two others.

Plants mostly small, perennial, biennial, and annual, with small white or yellow fls. mostly in racemes: lvs. (or at least the lowermost) usually pinnate or pinnatifid, commonly glabrous: fr. a silicle or short silique, globular to cylindrical, with strongly convex nerveless valves; seeds usually many, small and marginless, in most species in a double row in each locule, the cotyledons accumbent.—Species more than 50, widely spread in eastern and western hemispheres, inhabiting low grounds, swamps, and pools or streams, mostly weedy in character. These plants formerly appeared under the name *Nasturtium*, which, however, dates only from 1812 whereas *Radicula* dates from 1756. These plants probably should bear the name *Roripa*, which see. The nasturtiums of gardens are very different plants, members of the genus *Tropaeolum*.

Armoracia, Robins. (*Cochlearia Armoracia*, Linn. *Nasturtium Armoracia*, Fries. *Roripa Armoracia*, Hitchc. *Armoracia rusticana*, Gaertn.). **HORSE-RADISH**. Stout perennial, 2-3 ft. high, from deep hard root: root-lvs. large and dock-like, oblong, crenate or sinuate or the lower early ones often deeply pinnatifid into narrow segms.; st. lvs. lanceolate or the uppermost linear, entire or toothed: fls. white and rather showy, numerous, the style short: pods seldom seen, globular, on ascending pedicels. Eu.; escaped in N. Amer. in moist places and along water-courses.—The long tough roots furnish the horse-radish of gardens. See *Horse-Radish*.

Nasturtium-aquaticum, Brit. & Rend. (*R. officinalis*, Groves. *Sisymbrium Nasturtium-aquaticum*, Linn. *Nasturtium officinale*, R. Br. *Roripa Nasturtium*, Rusby). **WATER-CRESS**. Spreading and rooting soft perennial: lvs. more or less irregularly pinnate, of 3-11 oblong or roundish nearly entire or somewhat angle-toothed segms. or lfts.: fls. white, in racemes that elongate in fr., the petals twice exceeding the calyx: pods cylindrical, an inch long more or less, on spreading pedicels, short-beaked. Eu., but widely naturalized in streams in N. Amer.—The herbage of this plant is



3331. Radish forms.—1, Triumph, very flat or oblate form; 2, Early Dark Red; 3, Early White Turnip radish; 4, Triumph, elongated form; 5, Triumph, typical form; 6, Early Dark Red, another form; 7, Gray Summer Oval; 8, Long Brightest Scarlet; 9, Wood Early Frame; 10, Early Deep Scarlet Olive.

much used for garnishing and for salads. See *Cress*. In the tropics *Nasturtium indicum*, DC. (see *Roripa*), is a desirable cress. This is an erect annual, with yellow fls. and deeply pinnatifid (rarely entire) radical lvs. It is said to have been cult. in Europe, but it is probably useless or at least unnecessary outside the tropics.

L. H. B.

RADISH (Latin, *radix*, a root). A name applied to certain forms or species of *Raphanus* (of the family Cruciferae), particularly to the kinds that produce thickened edible roots; these roots are eaten raw, except some persons cook the large summer and winter kinds. See *Raphanus*.

The radish is variable in size, shape, color, and consistency of root and in season of maturity. Varieties may be classified as spring, summer, and winter radishes; or as globular, half-long, and long radishes; or as red, white, gray, and black radishes. Figs. 3331-3333 show some of the forms.

The origin and nativity of the radish are questions of dispute. For geographical reasons, it is supposed that the radish is wild in temperate Asia, probably in the oriental part, although truly indigenous radishes are doubtfully known. Not infrequently the radish runs wild about gardens, and in that case the root soon deteriorates into a small slender woody and more or less fibrous member. It has been thought by some that the radish is only a modified form of the wild charlock, or *Raphanus Raphanistrum*. In fact, experiments were made on the charlock by Carrière, who was able in a few years to produce edible radishes from the wild plant (cf. *Cyclo. Amer. Hort.* IV:1487). While these investigations seem to be conclusive that the radish can be produced from the charlock, they nevertheless do not prove that such was the actual origin of the garden radish. DeCandolle, whilst accepting Carrière's experiments, was unable to understand how the radishes of India, China, and Japan could have originated from the charlock, since that plant is unknown in those countries and the radish has been grown there for centuries. It is possible that the radish was carried eastward from western Asia and Europe, but such has not been the general course of the migration of plants. It is possible that the radishes of the Orient are a different

The summer and winter radishes are not popular in this country unless among those of recent foreign origin. The winter radishes in particular are little grown. These are late-maturing kinds, requiring more of the season for growth, and of such large size and firm flesh that they keep well, as turnips are kept. The summer and winter radishes require no special treatment, except that plans must be made to allow them a longer period. In eastern Asia are singular kinds of radish that are little known here. In North America, the small spring radishes comprise practically the range of general cultivation.

The rat-tail radish, Fig. 3346, is grown for its much-developed soft pods, which may be used as are radishes and in the making of pickles. It is rarely grown in American gardens, although it is well worth raising as a curiosity. It is annual, and its cultivation presents no difficulties. There is also a fleshy podded radish of parts of India, with the edible pods short and soft.

The radish is one of the most popular of garden vegetables. It is of quick growth, and the product is secured at the time of the year when fresh vegetables are in demand. In order that radishes may be of the best quality, they should have made a rapid growth. The soil should be rich, light and loose,—one that drains readily and does not bake with heavy rains. Radishes fit for the table may be had in three to six weeks from the sowing, depending on the variety and the "quickness" of the soil. They are often grown as a catch-crop with other vegetables. They may be sown in the rows with early beets, peas or other crops, and they are usually mature enough for use before they seriously interfere with the main crop. Sometimes seeds of radishes are sown in the rows of slow-germinating plants, as carrots and parsnips, in order that the seedlings may mark the row and thereby facilitate tillage. Many of the radishes, in such cases, may be allowed to remain long enough to produce an edible tuber.

Aside from the root-maggot, the radish is relatively free from insects and diseases. When the root-maggot appears in any place, it is usually best to discontinue the growing of radishes in that area for two or three years, until the insects have been starved out. The maggots may be killed by an injection of bisulfide of carbon into the earth about the plants; but this is usually more expensive than the product is worth. Carbolic acid emulsion may also be used. Early radishes may be grown in hotbeds or cold-frames with the greatest ease, and in these places they are usually less subject to the attacks of the cabbage maggot, since the crop is matured in advance of the maggot season.

Radishes are readily forced in the winter months. It is necessary that the house be light. The soil should be a sandy loam, free from silt and clay. It is best to grow radishes in solid beds rather than on benches. They thrive best in a low temperature. The temperature during the day should not exceed 65° to 75° in the shade, and at night it may drop to 45° to 50°. If the temperature is too high, and particularly if the beds are given bottom heat, the plants tend to run to top rather than to root. The seed is usually sown in rows from 5 to 8 inches apart, and they are thinned in the row until they stand 2 or 3 inches apart. In order that the crop shall be uniform and mature simultaneously, it is advisable either to sift the seed or to transplant the young radishes. Galloway has found by experiment that radish seeds $\frac{3}{4}$ inch in diameter are too small to give a satisfactory and uniform crop. He therefore advises that seeds be run through sieves with a mesh of that diameter in order to separate the small specimens. In a certain experiment, he secured from two pounds of commercial seed nineteen and one-half ounces of large



3332. Half-Long Scarlet radish. ($\times \frac{1}{2}$)

species from those in Europe, although they are generally regarded as the same species. Recent experiments in France (Yvonne Trouard-Riolle, "Recherches morphologiques et biologiques sur les radis cultivés," Nancy, 1914) indicate that the cultivated radish has not been derived from *R. Raphanistrum* by cultivation, but that *R. sativus* is specifically distinct although little known as a wild plant. It is supposed that the Japanese radish is derived from one aboriginal form of *R. sativus* which is native of China and Japan, and that the European radishes have come from another aboriginal form.

seed, ten and two-third ounces small seed, the remainder being bits of gravel, sticks and other impurities. The chief value of this sorting lies in the greater uniformity of the crop. Almost every plant can then be relied upon to reach maturity. It is the practice in some houses to transplant the young radishes. The seed may be sown in flats or in beds at one end of the house, and when the radishes have made two or three leaves, they are transplanted into permanent quarters. In this operation, all the small and weak plants are discarded and the crop is therefore more uniform. It is supposed by some growers, also, that the breaking of the tap-root in the process of transplanting tends to make the tuber shorter and thicker and to induce an earlier maturity. By means of transplanting, the use of the house may be economized. Whilst one crop is growing, another may be started in a seed-bed or in flats. As soon as the first crop is removed, the ground may be thoroughly raked, fertilized, and the new plants put in. In some cases the new crop is transplanted between the rows of the old crop a few days before the latter is removed; but, unless the soil is rich and in good condition, it is better to wait until the crop is removed in order that the land may be thoroughly fitted for the new plants. Radishes are often forced in connection with lettuce, and they thrive well in the same temperature. The varieties most used for forcing, as also for the early spring crop in the garden, are the globular or half-long kinds. With these varieties, a depth of soil of 4 inches is sufficient for good results.

L. H. B.

Another view of the cultivation of the radish.

There are few garden roots in which fresh crispness is more essential to palatability than in the radish, or which can be more easily held in prime condition for so long after gathering, and usually one is able to secure roots of excellent quality from the market. On the other hand, an abundant family supply can be grown on a small area and the radishes can be quickly gathered and fitted for the table, so that every country garden or even town yard may be easily made to furnish a family supply. Radishes are cool-weather plants, and although when young or quickly grown they may be killed by severe or long-continued freezing, they will endure a moderate frost without injury; the plants do not thrive and the roots become tough and unpalatable if grown in a temperature above 60°. Radishes have been in cultivation since earliest historical times and there has been developed a wide range of varietal forms. In some varieties the plants develop very rapidly and are well suited for raising under glass or for growing in gardens in the spring and early summer, while other sorts are of slower growth and come to greatest perfection when planted so that they will escape the summer heat and develop during the cooler weather of autumn.

Forcing varieties.

A group of varieties of radishes has been developed in which the roots reach usable size very quickly,—in some stocks by the time the cotyledons are full sized and before more than three or four leaves have developed,—so that under favorable conditions a culture may be planted, grown to maturity, marketed and the beds made ready for a second planting within thirty or forty days. In this group the roots are in prime condition but a short time, quickly becoming pithy and unpalatable, particularly if subjected for even a few hours to temperatures above 60° F., and uniformity as to maturity is an important quality. Often in a lot of seed of uniform varietal character, the seed varies greatly in size of grains and it has been found that plants from the larger seed mature some days more quickly than those from the smaller grains, so that the sifting out and rejection of the smaller seed is often desirable.

There are a number of varietal forms suited for for-

cing, ranging in shape from those distinctly flat, through flattened, thickened or long turnip-shaped, and globular, to tankard or half-long, and in color from white through various shades of red and yellow to dark purple. In some varieties the color is of uniform shade over the whole root, in others more or less of the lower part is white, while in other strains the generally white surface is marked with dots and splashes of red. In the forcing of radishes, uniformity as to rapidity of maturing and in attractiveness of color are the most important qualities. The success of any culture is very dependent upon the varietal character of the seed used, and seedsmen are continually offering under new names stocks that are in reality but superior strains of the older varieties.



Spring radishes.

These are slower in coming into usable size than the forcing sorts, but the plants are larger, hardier both to cold and heat, and the roots are larger and continue in prime edible condition much longer. In garden cultures, the first sowing should be made as soon as the ground can be worked and ordinarily it will furnish usable roots in twenty-five to thirty days and remain in edible condition from five to twenty days. To secure a succession, two to five sowings should be made at intervals of ten to twenty days, but it is useless to attempt to grow radishes in the hot weather of midsummer, as they would not only make a poor growth but the roots would be tough, strong-flavored and unpalatable.

Radishes require for their best, or even for a good development, a rich friable soil which has been made so by heavy manuring and judicious culture in previous years rather than by recent working. The use of fresh stable-manure is very likely to result in ill-shaped coarse-grained strong-flavored roots, and the uniformity and symmetry of the root is very dependent upon the fertility and friability of the soil. The seed should lie some ten to twenty grains to the foot, in drills about 2 inches deep, and covered with about an inch of soil. It has been found advantageous, just before the starting plants begin to push through the soil, to cover the row with a liberal sprinkling of either tobacco dust, or of land plaster and kerosene, as a repellant to black beetle and other insects.

Seedsmen offer a wide range of varietal forms, ranging from the quick-maturing red or white Olive-Shaped, the Half-Long or the Long Scarlet, to the later-maturing longer-seasoned Chartier, or White Vienna, and the still larger later Strasburg or Stuttgart, which might be classed as summer varieties, although when planted so as to mature in the heat of midsummer they are likely to be strong-flavored and unpalatable.

Fall and winter radishes.

There are varieties which develop to usable size more slowly than the preceding and which remain crisp and tender much longer. They should not be planted until midsummer or later so that they may come to maturity in the cooler weather of autumn. These require more room for their best development than the spring varie-

3333. A dainty bunch of spring breakfast radishes. (× $\frac{3}{4}$)

ties but are even more responsive to fertile well-prepared soil and frequent cultivation. They may be used as they reach desirable size and will stand considerable frost without injury, but should be pulled and stored much as one would carrots or parsnips so as to avoid severe freezing. The Long Black Spanish, the White Russian, the Chinese Scarlet Winter and Deep Scarlet Panier, the latter one of the most symmetrical and beautifully colored roots in cultivation, belong to this class which is well worthy of more general cultivation.

Chinese and Japanese radishes.

These are possibly the oldest of cultivated kinds. The large many-leaved plants are 2 feet or more across and form immense roots which not infrequently weigh forty to fifty pounds. The flesh is less agreeable in texture and flavor than that of the sorts more commonly grown, and though they have been loudly exploited by seedsmen, they have never come into very general cultivation in this country, except by the Chinese and Japanese who use them as a cooked vegetable more than as a salad.

Seed-growing.

There are few garden vegetables in which uniformity of varietal character is more important to satisfactory results than in the radish. This is particularly true of the quickly maturing forcing varieties, the seed of which is largely grown in Europe. As grown there, carefully bred stock-seed is sown thickly in narrow rows and when the most mature roots reach usable size, the crop is pulled, all immature or off-character roots are rejected, and those which are of satisfactory form, size, and color are promptly reset about 10 inches apart in rows about 3 feet apart and soon start into fresh growth and mature a crop of seed.

In this country, seed of both the forcing and larger-rooted sorts are commonly planted ten to twenty to the yard in drills, 3 feet apart, and when the plants are mature enough to indicate their varietal quality, the plantings are carefully gone over, the inferior and superfluous roots pulled and destroyed, and superior ones to furnish the desired quantity of stock-seed are pulled and set in a block by themselves, where there will be little danger of the flowers being fertilized by pollen from other plants.

The yield and quality of seed is very dependent upon uniformly favorable weather conditions inducing a quick, even growth, fertilization of the flowers by insects, and freedom from storms or exceptionally high temperatures. A hive or two of bees in the field will often materially increase the yield of seed. When the later and the most immature pods begin to ripen, the plants may be cut and laid in windrows or piles not over 3 to 4 feet deep on the threshing-floors and allowed to remain from ten to fifty days (depending upon weather conditions), until the stems are fully cured and dry. The seed may then be threshed out either with flails or machine and sacked, but must be watched, and if necessary, winnowed out, to prevent heating. In some localities it is a better practice, particularly with the later sorts, to leave the harvested plants under shelter until midwinter or early spring before threshing. Again, in case of some of the later harder-fleshed sorts, better yields are secured by not planting until autumn, and before severe weather, pulling, topping, and storing the small roots until spring, much as is done with seed-crops of beets or turnips.

W. W. TRACY.

RAFFIA is the Malagasy name of a palm which furnishes a staple article of commerce called raffia fiber. It is indigenous to Madagascar, where it grows without cultivation or attention of any kind. One palm leaf, or frond, produces eighty to one hundred long green

divisions 2 to 5 feet in length, like the leaves of the sugar-cane, but of a dark lustrous green color and thicker and stiffer. The under part of this green leaf is of a pale greenish yellow color, and from that side the inner skin is peeled off in the same manner as the skin on the outside of a pea pod, except that it peels off straight to the tip without breaking. It is then of the palest green, and after being dried in the sun assumes a light straw-color. This is the raffia fiber of commerce.

Raffia fiber is extensively used by the natives for making cloths called silk lambas and rebannas, which bring fancy prices in Europe and America, where it is used in the manufacture of various kinds of hats, and the like. A large trade is also had in raffia fiber in Europe for use in the manufacture of fancy baskets, but in America, while raffia fiber has been used to a limited extent in the manufacture of hats, its principal use is for tying vines, flowers, asparagus and celery bunches and for grafting. It is soft as silk and not affected by moisture or change in temperature so as to risk cutting or wounding the most delicate tissues, and it does not break or ravel when folded or knotted. These qualities bring it into general use in Europe, especially in the vineyards of France, where it is extensively used, and consequently maintains its price. It is virtually inexhaustible in Madagascar, the supply being limited only by the scarcity of labor. For export, the fiber is collected in large skeins, twisted or plaited, and then packed in compressed bales of about 100 kilograms (220 pounds) each. About 20,000 bales are exported annually.

CHAS. W. JACOB & ALLISON.

RAFFLESIA (named for Sir Thomas Stamford Raffles). *Rafflesidaceæ*. Fleeshy parasites, with a solitary large sallow fl. with a cadaverous odor rising from a superficial rhizome, leafless; fls. dioecious; perianth fleshy, the tube hemispherical at the base, solid in the male fls. and adnate to the ovary in the female fls., broad-campanulate above the ovary, limb 5-parted, the segms. imbricated in 1 row; ovary inferior, with numerous ovules. About 5 species, Malaya. *R. Arnoldii*, R. Br. Fls. flesh-colored, 3 ft. across, mottled with a thick fleshy rim or corona lining the upper part of the tube. In the male fls. there is a thick fleshy column within the corona and adherent to the perianth-tube and having at the top a wide flat plate, the overhanging margin of which is revolute and on which is placed a ring of sessile anthers. The female fls. are similar, but lack the anthers and possess an ovary adherent to the base of the perianth-tube and having a single cell. Sumatra. G. 7:547. J.H. III. 54:373.

RAILROAD-GARDENING. That phase or application of landscape gardening (or landscape architecture) which aims to improve the appearance of railway rights-of-way and station grounds; and, as an art of design, which lays out the approaches and makes the subdivisions of the grounds as best to serve convenience and beauty.

In this article, in a cyclopedia of horticulture, it is not intended to discuss the theory of design for railway properties, but rather to consider the plant-growing features; yet the layout must be taken into consideration. The subdivision of the property and the general theory of arrangement are necessarily controlled by the nature of the property itself, the extent of track-age, the need for passenger and freight access, the size of settlement to be served. Probably nowhere are the main elements more rigidly fixed by the necessities of the case, for the engineering requirements must be met; and yet there are large civic relations that should receive careful consideration.

In a small suburban railway station property, the planting feature may well be very prominent or even, to the general observer, dominant. Large trees are in place, and flanking lines of shrubbery and many good

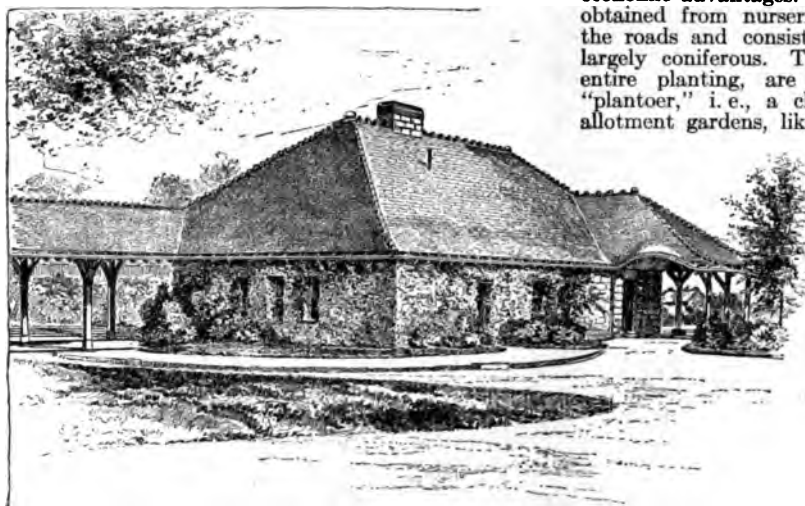


XCV. Radish, in several varieties.



20

gardening features. In small cities, of say 10,000 inhabitants more or less, the station buildings become relatively more dominant and the planting falls into a subordinate place, and the gardening may take on the features of ornament; the approaches and the general layout begin to assume a civic character. In large cities, the architecture, arrangement, and formal approaches necessarily dominate, the plant materials are reduced to a very minor feature or disappear altogether, and the landscape architect approaches the work as a problem in city-planning and design. There remains the small country station in the farming country, which usually has been wholly neglected in respect to its landscape features and which has little expanse beyond the mere right-of-way; this is a problem quite by itself and which has not yet been studied to any



3334. A good rural station, with well-directed approaches, sward, trees, shrub-planting, and vines on the building.

extent. This application of the landscape art to real rural conditions will develop when the whole subject of country-planning begins to appeal to the public mind.

Historical sketch.

The railroad-gardening movement is best understood by a consideration of its historical development, and this is here attempted, although the treatment is not complete nor does it pretend to bring the subject down to date.

The movement in England.—Planting has been practised on the station grounds of some English railways for many years, but it is almost exclusively limited to purely ornamental gardening. The corporations do little beyond offering prizes to station-masters and their assistants. This system was put in operation about forty years ago on the Great Eastern, in about 1885 on the Midland, and at a more recent time on the Great Western Railway. The prizes range from 5s. to £5, and in 1900 aggregated £300 on the Midland Railway. The little planting that is done by the railway companies themselves is confined to a few trees of low growth near stations, to a background of shrubs for some of the so-called "platform gardens," and to sowing broom and gorse on certain slopes of the permanent way between stations. The "allotment gardens" that attract attention on English roads are small tracts near stations rented to employees of the roads, who use them as vegetable-, fruit-, and, to some extent, as flower-gardens. The Railway Banks Floral Association was an interesting factor in the improvement of English railway rights of way. Earl Grey was the originator of the novel and excellent scheme. The society was an organi-

zation for interesting owners of adjacent property, and for collecting money and materials for sowing and planting railway "banks" (downward slopes) and "cuttings" (upward slopes) of the permanent way, to the end of making them more attractive. The results have been eminently satisfactory.

Denmark.—In Denmark the railways belong almost without exception to the government, and improvements are begun when the roads are constructed. These consist of five classes of work: (1) planting of station grounds; (2) hedges as a substitute for fences; (3) snow-shelters; (4) vegetation on embankments as a protection against erosion; (5) allotment gardens near block signal stations. Planting on station grounds is purely for esthetic purposes; the other features, while possessing some attractions, are maintained chiefly for their economic advantages. The materials for planting are obtained from nurseries ("planteskoler") owned by the roads and consist for the most part of shrubs, largely coniferous. These nurseries, as well as the entire planting, are under the supervision of a "plantoer," i. e., a chief botanical instructor. The allotment gardens, like their English namesakes, are

tracts near the block signal stations where railway employees conduct vegetable- and fruit-gardens for their own use, and sometimes care for a few flowering plants.

Sweden.—Ornamental planting has been universal on government railways, as well as on most private railways in Sweden, since 1862. According to the Royal Administration of the Swedish State Railways, the following distinctions are made: (1) decorative and fire protective plantings on station grounds; (2) mixed plantings (decorative and economic) on "habitation grounds;" (3)

plantings along the railway lines as hedges or for protection against snow. Station planting consists of trees selected to suit the climate of various parts of the country, of shrubs, and of perennials and annuals (flowering as well as bedding plants). At the largest stations (only about seventy-five) annuals are exclusively used for "modern or elegant combinations." The planting at habitation grounds consists of fruit-trees, small-fruits, a few ornamental shrubs, some flowering plants, and a small kitchen-garden. The state railways yearly plant out about 40,000 hardwooded plants (trees and shrubs), and 400,000 softwooded plants (perennials and annuals), which are nearly all grown at five greenhouses, hotbeds, and nurseries situated in different parts of the country. On private railways the same plan is followed on a smaller scale.

In various other countries there are scattered examples of ornamental, economic, and protective planting on railways, including the cultivation of fruits along the rights of way of certain railways of Germany and of France.

The Canadian Pacific Railway Company has planted a considerable part of its right of way to tamarack and other suitable trees to supply the tie material of the future.

The director of the association called Het National Belang, at Utrecht, says that the association has contracts with the State Railway Company and the Holland Railway to plant the dykes of their roads. Different kinds of willows, low apple and pear trees (half-stam appel en peeren-bloemen) and wild prune trees are used, the fruit of the last being "used for jams."

The common quince is used to a limited extent in Uruguay for binding earth on embankments, and the paradise tree for shading station platforms. "The Ombu is the national tree of Uruguay,—useless as fuel or as timber, useless as food, but as welcome as Jonah's gourd at midday at certain seasons."

The Royal Railway Department of Siam reports through M. Klope, acting Director General of Railways, that efforts have formerly been made to establish protective tamarind hedges along embankments in the Korat section, which were destroyed by cattle; Eucalyptus trees grown from seed received from Australia have developed quickly into "stately trees;" and good success has also resulted from the introduction of a tree from Manila which is said strongly to resemble the cherry tree, and is well suited for making "shady alleys;" and that India-rubber trees are used at smaller stations.

Remarkable work has been accomplished in Algiers. The director of the P. L. M. Railroad Company wrote some years ago that about 525,000 trees had been planted between 1869 and 1875, of which 495,000 were forest trees and 30,000 fruit-trees. The prevailing forest trees are eucalypts and locusts; others are mulberry, plane, pine, cypress, willow, poplar, oak, sycamore, and mimosa. About one-fifth of the forest trees were planted about stations and watch-towers for ornament, and the remaining four-fifths were used in protective plantings. The fruit-trees include mandarin, orange, lemon, medlars from Japan, pomegranate, apricot, and almond.

In Mexico some companies, notably the Mexican Central, maintain flower-gardens and parks at larger stations.

United States.—The first traceable indications of the movement in this country are about 1870. It was not until several years later that infrequent allusions to the work crept into print. From the year 1880, however, the movement gained in favor so rapidly that the late W. A. Stiles said of it in "Garden and Forest," March 13, 1889: "Railroad-gardening has come to be considered a necessary part of constructions and maintenance among prosperous and progressive companies seeking to develop local passenger business."

As nearly as can be determined with certainty, the first railroad-garden made in this country occupied the triangular plot of ground formed by the main line and the "Y" of the Baltimore & Ohio Railway, at Relay Station, where the through line from Washington joins the main line from Baltimore to the West. Frank Bramhall, of the passenger department of the Michigan Central Railroad, says of this plot: "I first saw it just before the Civil War." "Harper's Magazine" for April, 1857, gives a wood-cut of this station and its surroundings, but makes no mention of the planting.

The first example of gardening known to have been made by official order, as far as can be learned, was to be seen in 1869, on the line of the Central Railroad of New Jersey, on the stretch between Elizabeth and Bound Brook. The credit for this was directly due to the president of the railroad, J. T. Johnston. That gentleman was therefore one of the pioneers, if not actually the first American railway official to recognize the advantages, and to encourage the development of such improvement of station grounds.

Another early example, also on the Baltimore & Ohio road, is a little flower-garden which has been maintained at Buckhorn Point, on a narrow strip of ground between the tracks and the edge of a precipitous height overlooking the valley of the Cheat River.

In 1880, the Boston & Albany Company built a new station at Newtonville, Massachusetts, and a baggage-master (E. A. Richardson?) who took charge at that point in 1881 evinced an interest in the care of the grounds that attracted the favorable attention of the assistant engineer, who sent him men and material for grading

and sodding. This so encouraged the baggage-master that he solicited the townspeople for money to buy seeds and plants, and with such success that he maintained for three years a flower-garden that favorably impressed the higher officials of the road, and led to the establishment of similar gardens at other points, and eventually to the adoption of a system of planting which, under intelligent artistic supervision, has been radically changed in style till it now stands as the nearest approach to a comprehensive and consistent example of railroad-gardening. (Fig. 3334.) In 1882 and 1884 several new and exceptionally artistic stations had been built for the Boston & Albany Railway Company after designs by the late eminent architect, H. H. Richardson, and the latter date marks the adoption of a consistent scheme of permanent planting, aiming at nature-like effects instead of the purely ornamental, i. e., formal gardening, previously used. This happy result was due to the influence of Charles S. Sargent, of



3335. One method of treating a railway ground,—temporary formal ornament and no durable flank-planting.

the Arnold Arboretum, a director of the road, and to Wm. Bliss, its president. Designs for the improvement of the grounds around these stations were made by F. L. Olmsted, the veteran landscape architect, and since 1884 the development of these plans, as well as all of the horticultural interests of the road, have been in charge of a competent landscape gardener, E. A. Richardson, who says: "The plan followed is to conform the treatment and development of the station grounds to the adjacent ground: a natural style being followed amid natural surroundings, and a more cultivated style in highly cultivated regions; to utilize all natural advantages of ground surface, rocks, water, and native growths; to make large use of trees, shrubs, vines, and plants indigenous to the locality where improvements are being made; to supply beds for shrubs with from eighteen to twenty-four inches of good loam; and to plant so closely in the beginning that as the plants grow they can be thinned to supply other grounds as needed." It goes without saying that these methods are not only the most practical but that they insure the most artistic results.

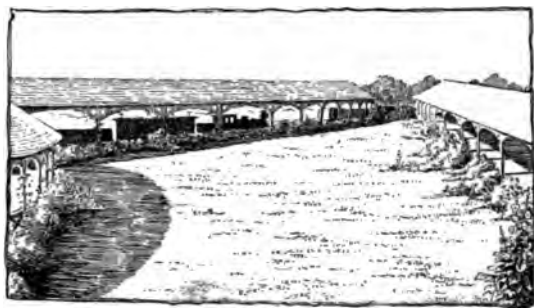
Among the first railway companies to improve their station grounds by planting were the Central of New Jersey (1869), the Baltimore & Ohio (date uncertain), the Boston & Albany (1880), the New York Central & Hudson River (1880), the Erie (1881), the Southern Pacific (1885), the Pennsylvania (1886), and the Austin & Northwestern of Texas (1887). Other roads appreciate the value of the work and encourage it; and railroad-gardening has now become a recognized form of landscape improvement, although yet at its merest beginnings.

The methods.

In the public mind, railroad-gardening usually means the formal use of flower-beds about stations. Such work is ornamental gardening, not landscape gardening. Most of the so-called landscape gardening at railroad

stations is really merely decorative. Carpet-beds are relatively costly as compared with hardy shrubbery. They last but a few months and then leave bareness, while the best hardy trees and shrubs skilfully arranged are interesting all the year round. (Figs. 3335, 3336.) This making of nature-like pictures with relatively simple, inexpensive, and permanent materials is a much higher art than that involved in creating and maintaining flower-beds and a few summer-blooming plants. However, both have their places. Many a tired traveler is cheered by the bright colors of a neatly kept railroad station. Such displays are suitable at the stations if anywhere along the line. They are always preferable to dirt, ugliness, and a general air of indifference. But railroad-gardening never becomes worthy our best attention until it rises to the plane and importance of planning. (Fig. 3337.)

Some of the underlying considerations in the landscape improvement were stated in an editorial in



3336. A better method of treating the area.

"Garden and Forest," 1889, by the late W. A. Stiles, from which we quote: "Up to the present time, with few exceptions, railroad-gardening has failed to accomplish what the public has a right to expect of it from an artistic point of view. Instead of using their opportunities for increasing the taste and knowledge of the communities they serve, railroad managers have generally been satisfied to reproduce all that was glaringly bad in the prevailing horticultural fashion of the time. Perhaps this is inevitable, and it will continue so as long as they feel that they need not call for the advice of an expert of a higher class than the ordinary jobbing gardener. It is the old story—a man employs an architect to build his house, but thinks he needs no advice in laying out the park that surrounds it.

"The principles that underlie good railroad-gardening are simple. They relate,—so far as such gardening has been attempted,—to the immediate surroundings of country stations and to the shaping and turfing of the slopes rising and falling from the permanent way.

"The essential features are: convenient and abundant approaches, and some treatment of the ground not needed for approaches. This treatment should be at once economical and permanent, and of a character simple enough to be successfully maintained by the station-master and his assistants, under the inspection and with the occasional advice of a higher official charged with the management of the horticultural affairs of the corporation.

"The selection of a system of general treatment is the only difficult thing, and it is here that railroad managers have usually failed. Most railroad-gardens,—and this is as true of Europe as of America,—consist of a badly laid out and constructed approach, bordered with turf in which are cut as many large and often grotesquely shaped beds as can be crowded in and filled during four months of the year with the most showy and ill-assorted plants, and quite bare of all covering during the remaining eight months; of a few shrubs, mutilated almost past recognition by bad pruning, and by a clump of

pampas grass to complete the decoration; also often the name of the station in stones (mere 'toys'). As Bacon wrote three centuries ago, 'You may see as good sights many times in tarts.' Such grounds are not artistic, and are therefore bad from the point of view of the public. They are enormously expensive and difficult to maintain, therefore bad from the point of view of the railroad.

"If railroad-gardening is ever to become a potent and permanent means of public education, it must be organized upon a more economical basis, and with more regard to the laws of good taste and good business. This subject has already occupied the attention of a few thoughtful men, and we are confident that some progress has at last been made." Mr. Stiles commends the plans of the then new station grounds of the Boston & Albany Railway for "convenience, neatness, and simplicity. No beds, no brilliant flowers, no startling effects. They rely for attractiveness on convenient, well-kept roads, neat turf, a few good trees, and masses of well-selected and well-planted shrubs, among which herbaceous and bulbous plants are allowed to grow. The plan is simple, and when thoroughly carried out in the beginning it is easy to maintain."

On the treatment of the right-of-way between stations, Mr. Stiles says: "What is needed is a ground-covering that will be more permanent than turf and will not need its constant cutting and attention, and which can be secured without the enormous first expenditure for accurate grading and the deep soil that makes a grass slope presentable," and adds: "Such low plants as wild roses, dwarf willows and sumacs, sweet fern, bayberry, etc., when once established will prevent surface soil from washing, will not grow tall enough to interfere with operating the road, and if destroyed by fire would soon grow again from the root and re-cover the ground."

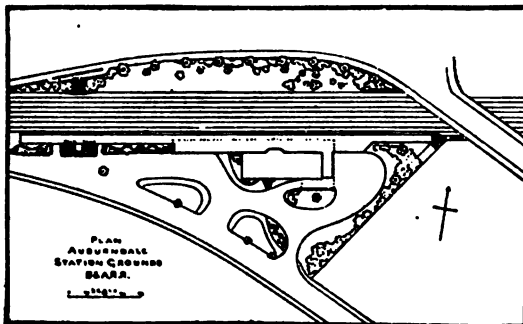
The proof of these deductions is seen yearly on many roads, where thousands of miles of railroad rights-of-way which, in the spring and early summer, are like ribbons of flowered brocade linking the towns together but later in the season become blackened wastes from accidental or intentional fires. Year by year this mournful program is repeated.

Railway officials offer no practical objections to the use of small trees and of shrubs between stations which apply when the work is done with discretion; viz., on the outer boundaries of rights of way that are 100 or more feet wide, on straight stretches, or on long tangents, and not on short curves or near grade crossings. The tracks should never be menaced by the danger of trees falling across them in wind-storms, nor should the telegraph wires and poles be interfered with, nor the view of the line obstructed. The danger to planting from fire can never be entirely eliminated until some non-spark-producing fuel is substituted for coal.

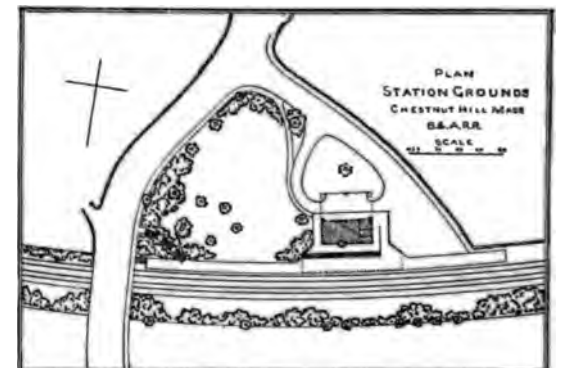
Planting for protection, as practised so far, includes: (1) covering banks with vegetation to prevent erosion, and (2) planting for protection from wind and snow, and from landslides. All this has been successfully done in various parts of the world. Snow-hedges are comparatively common at home and abroad. A notable example of confidence in the advantage of belts of trees for this purpose is seen in the groves planted some years ago by the Northern Pacific Railway Company. About 600,000 trees were set out in 1900, and the chief engineer of the road says: "This experiment has been undertaken to determine the possibility of substituting groves for snow-fences. It is necessary to protect all railway cuts in these prairie regions in some manner, as the strong winds across the treeless prairies cause the snow to drift badly. A strip 100 feet wide is cultivated to keep down weeds and overcome danger from fire, and through the middle of it runs a grove 60 feet wide, the inner edge being 125 feet from the center line and parallel with the tracks through cuts. The trees are

planted in parallel rows spaced 6 feet apart at right angles with and 3 feet apart parallel with the track. The two outer rows on each side are golden Russian and laurel-leaved willows; the third row from the outer margins, box-elder and ash; and the five central rows, cottonwood. This arrangement is expected to produce a dense grove, increasing in height from both sides to the center, which will furnish an effective windbreak." The feasibility of planting for protection against the encroachment of shifting sand on the seacoast, along rivers, and on so-called desert lands, has been demonstrated by the researches and experiments of the United States Department of Agriculture. The advantages of such plantings are sure to be eventually recognized and utilized by railway companies whose lines are exposed to this danger.

The disagreeable features and their suppression constitute an important phase of landscape improvement about railway properties. There are two important classes of disfigurement: defacement by signs, and defacement by abused and neglected grounds adjoining



3337. Plans of railroad-gardening.—On the left, Anburndale Station, Boston & Albany Railroad. The plan provides for a portico, a driveway, steps to an overhead bridge and to an underground passage. On the right, Chestnut Hill Station, Massachusetts. Both reproduced from "Garden and Forest."



railway rights-of-way. The more noticeable of these is the display of hideous sign-boards that disfigure railway rights of way and, indeed, seem to have the right of way on highways of every description. These amount to a public nuisance that should be legally controlled, but as they are placed on adjacent land or buildings instead of on railway property, their direct suppression by railway officials is out of the question. These eyesores, however, furnish an added and cogent reason for massing plantations of small trees, shrubs, and vines at certain points along rights-of-way where the topography of adjacent land invites such disfigurement. These gaudy signs not only blot out or mar most fine landscape views (being adroitly placed to that direct end), but are allowed to distort otherwise unobjectionable farm buildings, while the approach to villages and towns is announced in screaming colors by the crowding together of these frightful adjuncts of civilization. While railway companies are not strictly responsible for these conditions, it is certain that they might sway public opinion and effect a much-needed reform by continuous, systematic work in the way of "planting out" the disfigurements, and by establishing attractive plantations wherever possible. This policy is likely to result in a reformation in the direction of the second source of unpleasant views from trains; viz., the unkempt, sordid, and often wretchedly squalid appearance of grounds adjoining rights-of-way through villages, towns, and small cities. If a park is maintained on the station grounds, nearby residents are likely to catch the good spirit and improve the looks of neighboring back yards. To this end, a rule against dumping on railway ground should be strictly enforced. The objectionable features that obtain in large cities must

probably be endured until mitigated by the efforts of municipal art and social-service leagues.

Protection of natural scenery is a prime consideration. Notwithstanding the prominence given in railway advertising to fine natural scenery, little credit seems due to railway companies in general for protecting such scenery. That they might wield a mighty influence for their own and the public good is proved by a few examples. It is learned that the unofficial work of representatives of the New York Central and the Michigan Central roads did much to create the public sentiment that led to the formation of government parks on each side of Niagara Falls, and that the same roads should be credited with comprehensive and extended efforts to secure legislation looking to the prevention of further defacement of the palisades of the Hudson. Many of the movements for protecting natural views and worthy objects have close relation with the improvement of railway properties.

Planting for economic purposes is among the possibilities along rights of way, for the purpose of producing timber for furnishing cross-ties, poles, and posts. It is asserted that, under competent supervision, this branch can be made not only to pay the entire expenses of the department but to become a source of revenue. This branch of the work appeals to practical railway men as perhaps no other phase can be expected to, and to what extent the fortunes of various groves of locust, catalpa, and tamarack influence the point of view of chief engineers it would be difficult to learn, but that numbers of them are turning otherwise unoccupied railway lands to this use is certain. In Indiana, for example, some railway companies have planted a part of their holdings with trees for the double purpose of growing timber for economic uses and to secure the resulting reduction in taxes, which is a feature of the state forestry law.

It is often asked whether the planting or horticultural department of a railroad can be made partly self-supporting. There seems little doubt that by one means or another this department might be made at least partly self-sustaining, but the consensus of opinion among railroad men is distinctly against the advisability of making it so, except indirectly. It is conceivable that railroad nurseries and greenhouses might supply planting stock to individuals to their advantage; and possibly railway rights-of-way aggregating immense areas might be planted to crops, perhaps to fruit-trees as is done to some extent in European countries (a project which has also been recently suggested for the roads of India), but the opinion is general that legitimate railroad business is limited to the transportation of people and of freight. Even if this is true, it is still certain that

the department may legitimately be made to yield substantial financial returns. This feature of the department work is as yet in a preliminary stage that makes definite conclusions as to the extent of its benefits impossible, but enough has already been accomplished to demonstrate the usefulness of a well-conceived and correctly developed policy of protective and economic planting.

The attainable ideals are many. Railway companies can do no more effective advertising than by demonstrating the possibilities of the country traversed for home-making. Instead of dreary wastes of dust and cinders, their way-station grounds should present refreshing scenes of shade and verdure. Their grounds should be treated according to the rules of landscape art that hold good in all planting. When adjacent land drops away, giving good vistas, these should be preserved; objectionable features should, as far as possible, be "planted out;" sky-lines should be varied, banks clothed, and variety and views supplied, particularly in flat and uninteresting regions. Railroad-gardens should be in the hands of those who will adorn instead of deface them; who will look to the formation of features that will take care of themselves after planting is established—features that require considerable expenditure, a good knowledge of trees and of shrubs, and a large amount of taste in the designer at the outset, but after being established, like the island gardens of Paris, "the hand of man might be withheld for half a century without their suffering in the least." This conception of railroad improvement is therefore much larger and more inclusive than the mere adornment of station grounds; eventually it will modify the development of the entire property over which passengers ride.

FRANCES COPLEY SEAVEY.

RAISIN: *Grape*, page 1386.

RAJANIA (named in honor of John Ray, 1628–1705). *Dioscoreaceæ*. Sts. from tubers, twining, and the habit of *Dioscorea*: lvs. alternate, undivided, hastate, cordate-oblong or linear: fls. dioecious, small, racemose, the male along the rachis often fascicled or in very short racemes, the female and sometimes both sexes simple and on short slender pedicels; perianth-segms. 6; stamens 6 in the male fls.; ovary ovoid or oblong; fr. reduced to one carpel through abortion, key-like, indehiscent.—About 10 species, W. Indies.

pleioneura, Griseb. Fig. 3338. Tubers very irregular cocks-combed: plant subshrubby, 5–6 ft. high: lvs. cordate-roundish or cordate-ovate, 2–5 in. diam., deltoid-pointed or cuspidate, 9-nerved; petiole about as long as or shorter than the lf., the aerial tubers produced at the base of the petiole: fls. dioecious, in racemes which are often fascicled, the male racemes compound, 3–8-fld., flexuose, the female simple: samara semi-obovate-oblong, bluntish, wing twice as long as the seed. Cuba and other islands of the W. Indies.

F. TRACY HUBBARD.

RAMIE: *Boehmeria nivea*, a fiber plant. See *Cyclopedia of American Agriculture*, Vol. II.

RAMONDA: *Ramondia*.

RAMONDIA (named for L. F. E. von Ramond de Carbonnières, French botanist and traveler, 1753–1827). Usually spelled *Ramondia*, but first written *Ramonda*. *Gesneriaceæ*. Subcaulescent herbs with reddish lanate-villous hairs, suitable for rockwork.

Leaves basal, softly rugose: scapes leafless, 1- to few-fld.: fls. violet or pale purple; calyx free, 4–5-rarely 6-parted, the segms. ovate or oblong; corolla with scarcely any tube, rotate or broad-campanulate, 4–5-rarely 6-cleft, the lobes broad; perfect stamens as many as the corolla-lobes, affixed at the base of the

corolla; ovary superior, conical: caps. oblong, rather acute.—About 10 species, mountains of Eu.

Ramondia pyrenaica is one of the choicest and most interesting alpine plants. Few, if any, inhabitants of rock-gardens have been so often pictured. It is a small tufted, hardy perennial herb, like most alpine plants, and its scapes bear one or few flowers in spring. These are an inch or so across, and normally purple or violet, but there is a pure white variety which is in much favor. The ramondias vary in the number of their petals, or rather corolla-lobes. For example, *P. Nathaliæ* often has four-lobed and five-lobed flowers on the same plant. The floral parts in the genus are in fours, fives, or sixes. These plants are rare and local in Europe and are interesting as being among the few alpine survivors of a family that is now essentially tropical. Although several ramondias are in the trade, only one is well known. This is *R. pyrenaica*, which is hardy in the eastern states. It is a beautiful dwarf alpine plant well adapted for the rock-garden. It is rather hard to establish but can be easily grown from seed. If seeds



3338. *Rajania pleioneura*, showing aerial tuber. ($\times \frac{1}{4}$)

are sown in the spring, and the small plants grown along in pots for the first summer and kept in a cool shady position, they will make neat little plants by the end of autumn. They should be kept in a coldframe for the winter. These one-year-old plants grown in pots are much easier to establish than younger plants. They may be planted in small pockets in the rockery in a slightly shaded and elevated position, and given good deep peaty soil. When the plants become established they will blossom freely, and if allowed to ripen their seed they will sow themselves freely amongst the rocks. Old plants can also be increased by division. They ought to be covered in winter with hay or dry leaves so that they will not be heaved out of the ground by the alternate thawing and freezing. The plants require perfect drainage.

A. Color of fls. purple or white.

B. Corolla 5-parted, rotate.

pyrenaica, Rich. Sometimes called **ROSETTE MULLEIN**. Fig. 3339. About 3 in. high: lvs. ovate, deeply toothed, hirsute with long rufous hairs: scapes many, several-fld., rarely 1-fld.; fls. purple; calyx and corolla 5-parted, the latter with subobovate lobes. May. Pyrenees. B.M. 236 (as *Verbascum Myconi*). G.C. III. 12:vii. Gn. 26, p. 129; 27, p. 197; 29, p. 343; 37:30

and p. 31; 44, p. 555; 51, p. 205; 56, p. 228; 65, p. 113; 67, p. 71; 73, p. 374; 74, p. 327. G. 7:134; 33:139; 35:123. G.W. 1, pp. 16, 17; 15, p. 541. G.Z. 10:160. F.W. 1877:161. J.H. III. 34:187. R.H. 1866:330; 1906, p. 230; 1907, p. 447. Var. *álba*, Hort., is a white-flid. form. G. 23:485. Many inferior forms have been sent out under this name. *R. leucopétala*, Hort., *R. peregrina*, Hort., and *R. quercifolia*, Hort., are apparently only forms of *R. pyrenaica*. Well-grown specimens may have 6-12 scapes, each bearing 3-4 fls. $1\frac{1}{2}$ in. across.

BB. Corolla mostly 4-parted, more concave, short bell-shaped to funnelform.

Héldreichi, Janka (*Jancza* or *Jankza Héldreichi*, Boiss.). Lvs. ovate, entire, obtuse, silky white above,



3339. *Ramondia pyrenaica*. ($\times\frac{1}{2}$)

rusty-woolly below: scapes 1-2-flid.; fls. violet. According to Boissier it normally has a 5-parted calyx, 4-lobed corolla and 4 stamens. Thessaly. Gn. 55, p. 394. G. 35:197.

AA. Color of fls. yellow.

sérbica, Panc. This is said to be distinguished by its blue anthers; also the fls. are said to be normally 5-lobed. Servia. G.L. 24:146. Var. *Nathálie*, Hort. (*R. Nathálie*, Panc. & Petrov.), is more commonly 4-lobed than the type. Gn. 76, p. 203. G.W. 13, p. 553. S.H. 1:161.

F. TRACY HUBBARD.†

RAMPION (*Campanula Rapunculus*) is a vegetable sometimes cultivated for winter salads. The roots are chiefly used, generally in a raw state, but the leaves may also be used as a salad. The roots are white, a foot or so long, and spindle-shaped, like a long radish. They are ready for use in October or November and may be used all through the winter. According to Vilmorin's "Vegetable Garden," the seeds of rampion are the smallest of all kitchen-garden seeds, and their germinating power lasts five years. The seed may be sown in the open ground, either broadcast or in drills. The precautions usually taken with minute seeds must be observed. In order not to sow the seed too thickly, it is well to mix it with sand. The seed should not be covered, merely firmed into the soil. Frequent and careful waterings are necessary until the plants become established. Thinning is an important operation. Every plant allowed to remain should have at least 4 inches each way for development. The plants like a light rich soil, partial shade and water during the hot season. Although rampion is usually biennial, it sometimes runs to seed the first year, especially if the seed is sown early. It is, therefore, sometimes advisable to postpone seed-sowing until June. For botanical description, see *Campanula*.

RÁNDIA (named in honor of Isuae Rand). *Rubiacea*. Trees or shrubs, erect or climbing, unarmed or spiny, grown in the warmhouse for their bloom or hardy outdoors in the extreme southern United States.

Leaves opposite, obovate-oblong or lanceolate, often leathery; stipules short: fls. small or large, solitary, corymbose or axillary, fascicled, rarely terminal, white, yellowish or rarely rose; calyx-tube ovoid, obovoid or turbinate, limb rarely dentate or lobed; corolla funnel-shaped or salver-shaped, tube short or elongated; limb 5-lobed (rarely more), short or elongated; stamens 5; ovary 2- very rarely 3-4-celled: berry globose or ovoid.—About 100 species in the tropical regions, especially in Asia and Afr. Closely allied to *Mitrostigma* and *Gardenia*.

A. Shrubs having spines.

dumetorum, Lam. (*R. floribunda*, DC.). A small tree or rigid shrub with stout straight often long spines: lvs. 1-2 in. long, short-petioled: fls. white or greenish yellow, fragrant, not large, solitary or rarely 2-3 on a peduncle; corolla $\frac{1}{2}$ - $\frac{3}{4}$ in. across: berry globose or ovoid, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, yellow. Trop. Asia.—Cult. in S. Fla.

Thúrberi, Wats. PAPACHI. An upright shrub, 6-8 ft. high, armed with slender spines, young branches canescent: lvs. obovate, attenuate to the short, winged petiole, obtuse or retuse: fr. globose or ellipsoidal, axillary, sessile or nearly so; seeds about 20, in black pulp. Lower Calif. and Sonora, Mex.—Intro. into Calif. The fr. is eaten by the Indians.

AA. Shrubs or trees without spines.

B. Corolla-tube $\frac{1}{2}$ in. long.

Fitzálanii, F. Muell. A glabrous tree: lvs. often over 6 in. long, shining, obovate-oblong or elliptical, obtuse; petiole rather long: fls. about 1 in. across, in loose, few-flid. cymes or the fertile fls. solitary: fr. globular, $1\frac{1}{2}$ in. thick or ovoid and longer, hard. Austral.—Cult. in Fla.

BB. Corolla-tube 4-10 in. long.

c. Lobes of corolla obtuse.

maculata, DC. (*Gardenia Stanleyana*, Hook.). A much-branched shrub 10-15 ft. high: lvs. elliptical or obovate-oblong, $1\frac{1}{2}$ -5 in. long, $\frac{3}{4}$ -2 $\frac{1}{2}$ in. wide, chartaceous, acuminate, narrowed at base; petiole usually with glands near its union with the midrib: fls. usually purple with white lobes, solitary, terminal or at ends of short lateral branches, sessile: fr. oval, oblong or globose, pointed, $1\frac{1}{4}$ -3 in. long. Trop. Afr. R.H. 1894: 60. B.R. 31:47. B.M. 4185. Gn. 38:322. G.C. III. 54:79. R.B. 30, p. 5.

macrantha, DC. (*Gardenia macrantha*, Roem. & Schult.). A climbing shrub, 9-30 ft. high: lvs. oval or obovate-oblong, opposite, cuspidate or caudate at the apex, narrowed at the base; stipules persistent, glumaceous: fls. solitary, fragrant, terminal, 6-10 in. long, whitish; calyx-lobes linear or linear-spatulate, spreading; corolla with a slender green or yellowish tube and oval obtuse lobes: fr. globose or somewhat pear-shaped. Trop. Afr. G.M. 51:221.

cc. Lobes of corolla acute.

Ruiziána, DC. A tender shrub with dark green lanceolate acute lvs., and white or pale yellow fls. terminal, solitary, sessile: corolla-tube somewhat hairy; lobes spreading: fr. cylindrical, yellow, 10-nerved. Brazil, Peru.

F. W. BARCLAY.

F. TRACY HUBBARD.†

RANÈVEA (anagram of *Ravenea*). *Ravenea* of Bouché. *Palmæceæ*. One species of palm perhaps allied to *Hyophorbe*, from which it differs, among other things, in its dwarfer habit, usually dioecious fls. and in the fls. being arranged alternately on the short branches of the spadix. The genus *Ranevea* seems, however, to be of uncertain relationship. Bouché's generic name *Ravenea* dates from 1878. It appears in Bentham & Hooker (3:883) as *Ravenia*. In spelling it is so similar to *Ravania* of Vellozo, 1825, that the two cannot be distinguished by pronunciation, and there-

fore a new name was given. Cult. as in Hyophorbe. Prop. by seeds in stovehouse, under glass.

Hildebrandtii, Bailey (*Ravenea Hildebrandtii*, Bouché). Becoming 8-12 ft. high, but flowering under cult. when half that height, spineless, erect: lvs. elliptic-oblong or ovate-oblong in outline, long-stalked, pinnate, the pinnae 20 or more pairs and narrow-lanceolate-acute: spadix long-stalked, the staminate recurved and with short densely fld. spreading branches, the pistillate erect, with filiform strict branches thickened at the base: fls. pale straw-color, the calyx 3-lobed, the petals 3 and joined at the base, the stamens 6: fr. black. Comoro Isls. (east of Afr.). I.H. 27:403. B.M. 6776. G.F. 4:259.—An excellent dwarf palm, described by W. Watson to be "as elegant as *Geonoma gracilis* and as sturdy as a *Kentia*. It deserves to take a prominent place among garden palms, its small size, free habit, elegance, good constitution, being all in its favor, while in the freedom with which it flowers and produces seed we have an exceptional character among dwarf palms." Perfect fls. are sometimes produced, although the plant is usually dioecious. Described as one of the most valuable recent palms. L. H. B.

RANUNCULUS (Latin name for a little frog; applied to the genus by Pliny in allusion to the wet places in which many of the species grow). Including *Batrachium* and *Ficaria*. *Ranunculaceæ*. BUTTERCUP. CROWFOOT. Annual and perennial herbs, a number of which are grown in the garden and sometimes in the greenhouse for their showy flowers. Most of the species are hardy perennials, some of them aquatic.

Leaves entire or dissected; cauline lvs. alternate, often few: fls. white, yellow or red, terminal, solitary or paniced, rarely sessile at the branch axils; sepals 3-5, caducous; petals all or most (up to 15) provided with a honey-bearing pit or an enlarged conspicuous or rarely minute scale; stamens shorter than the sepals and petals, frequently numerous, sometimes only few in small-fld. species; carpels numerous, 1-ovuled: achenes compressed or subglobose, smooth or variously striate, costate, rugose, or spiny.—About 300 species dispersed all over the world, mostly in the temperate and colder regions, few in the tropics. The structure and arrangement of the achenes is well shown in Fig. 3340.



3340.
Head of
buttercup
achenes.

Culture of the ranunculuses. (E. J. Canning.)

The culture of ranunculuses in gardens and by florists has been confined chiefly to the Persian and Turban ranunculus, *R. asiaticus*, since the Asiatic species is far more attractive than the European. In England and in other European gardens, *R. asiaticus* has been in cultivation a very long time. Parkinson mentions it in his *Paradisus*, published in 1629. He termed it "the double-red crowfoot of Asia." Since his time *R. asiaticus* and its varieties have been greatly improved, both in size of flowers and variety of colors. The flowers are very double, almost globular in outline, and often exceed 2 inches in diameter, while the colors now embrace almost every shade except blue, and some are striped and variegated. A well-grown mass of these charming flowers when in full blossom is a sight not soon forgotten. They are not so well known in American gardens as in those of England or at least not in the eastern states, since the writer has rarely met with them or seldom seen any reference to them in the horticultural periodicals. They are not adapted to either spring or summer bedding. Their season of blossoming in this country is about the last week in May and the first week in June, which is too late for spring bedding, while the season of blossoming is too short for summer bedding. Therefore a position should be given them in

the herbaceous border where they will receive some shade during the warmer parts of the day, or a level place in a rock-garden with a northern aspect. The roots are tuberous, being like miniature dahlia roots. They are not hardy, at least not in any of the northern states. The tubers should be carefully lifted after the foliage has all "ripened off" (which occurs usually toward the end of August), and stored until the following spring in some cool shed where they will not freeze. They should be planted as soon as the frost is well out of the ground in spring, about 2 inches in depth and about 6 inches apart, making the soil very sandy on top so that the leaves will push through readily without heaving the soil. Like their congeners the European ranunculi, they like plenty of moisture at the roots during the growing season, and if they can be shaded from the sun when in flower their blossoming period will be materially lengthened. They may also be grown for flowering in the greenhouse. The gardener may well have a few pans each year, planting the roots in pans of light soil toward the end of January and placing them in the coolest greenhouse, where they will blossom toward the middle of April. He will probably prefer the Turban varieties, since they are stronger-growing and rather larger than the Persian. The species may be propagated by seeds, but this process is not worth while because the bulbs may be procured so cheaply.—Of the native and European species of ranunculus, those of the *Batrachium* section, such as *R. aquatilis* and its varieties, are interesting aquatic plants, while *R. repens* var. *flore-pleno*, and *R. amplexicaulis* are useful as subjects for the bog-garden.—For herbaceous borders or moist corners in the rock-garden *R. aconitifolius* var. *flore-pleno*, *R. cortusæfolius*, *R. anemonoides*, *R. parnasifolius*, and *R. Ficaria* are the only species worth growing. These are readily propagated from seeds or by division of the plants in spring. See the supplementary list, p. 2909, for some of these.

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KEY TO THE SPECIES.

- A. Sepals 3..... 1. *Ficaria*
- AA. Sepals 5.
 - B. Achenes transversely wrinkled, emarginate: petals with a nectar-bearing pit at base.
 - c. Lvs. setaceous-multifid: sts. submersed..... 2. *fluitans*
 - CC. Lvs. subreniform or rounded-cordate: sts. creeping in the mud..... 3. *hederaceus*
- BB. Achenes smooth or nearly so: petals usually with a nectar-bearing pit and scale, the latter sometimes imperfect or very minute in c.
 - c. Roots fascicled, more or less tuberous-thickened.
 - D. Sepals reflexed.
 - E. Head of achenes cylindrical-spicate; achenes slightly verrucose; beak straight: fls. numerous..... 4. *psilostachys*
 - EE. Head of achenes ovoid; achenes pubescent; beak recurved: fls. few.

- F. Lf.-blades 3-lobed or 3-parted: beak of achene recurved..... 5. *monspeliacus*
- FF. Lf.-blade pinnately compound, lfts. or segms. 5-7: beak of achene straight..... 6. *orthorhynchus*
- DD. Sepals spreading.
- E. Lvs. ternately or biternately cut: head of achenes cylindrical; achenes glabrous..... 7. *asiaticus*
- EE. Lvs. subcordately reniform, incised, lobes cut and dentate: head of achenes short-ovoid; achenes hairy on the sides..... 8. *cortusefolius*
- CC. Roots fibrous, not fascicled or tuberous thickened (bulbous in No. 11.)
- D. Fls. white, rose or rarely purple (yellow in a double-fl. variety of No. 11).
- E. The lvs. dissected.
- F. Sepals pubescent.
- G. Petals 5..... 9. *glacialis*
- GG. Petals 12-20..... 10. *Matthewsii*
- FF. Sepals glabrous.
- G. Sts. several-fl. 11. *aconitifolius*
- GG. Sts. 1-3-fl.
- H. Blades palmately 3-lobed: petals 5..... 12. *alpestris*
- HH. Blades pinnately cut, lobes 3-lobed: petals 8-10..... 13. *rutefolius*
- EE. The lvs. not dissected.
- F. Blades sessile and amplexicaul. 14. *amplexicaulis*
- FF. Blades petioled.
- G. Sepals glabrous: lvs. linear or lanceolate..... 15. *pyrenæus*
- GG. Sepals pubescent: lvs. rather cordate or ovate-rounded..... 16. *parnassifolius*
- DD. Fls. yellow (see also a double variety of No. 11; fls. scarlet in a form of No. 28).
- E. Lvs. not divided (although sometimes lobed).
- F. Lf.-blades rounded-cordate or reniform..... 17. *insignis*
- FF. Lf.-blades linear or lanceolate.
- G. Plants alpine, 6-12 in. high: lvs. linear or narrow-lanceolate: sepals glabrous..... 18. *gramineus*
- GG. Plants aquatic, 2-3 ft. high: lvs. lanceolate, sessile and somewhat clasping: sepals villous..... 19. *lingua*
- EE. Lvs. divided.
- F. Stolons present..... 20. *repens*
- FF. Stolons lacking.
- G. Base of st. bulbous..... 21. *bulbosus*
- GG. Base of st. not bulbous.
- H. Rootstocks present.
- I. Sts. glabrous: lvs. all radical..... 22. *Enysii*
- II. Sts. pubescent: lvs. both radical and cauline..... 23. *montanus*
- HH. Rootstocks absent (though a short, erect, thickened caudex is often present).
- I. Axis of infl. hirsute..... 24. *polyanthemus*
- II. Axis of infl. glabrous.
- J. Sepals spreading.
- K. Sts. lax or weak: petals 6-15: upper cauline lvs. wanting..... 25. *californicus*
- KK. Sts. strictly erect: petals usually 5: upper cauline lvs. present.
- L. Peduncles terete, not striate..... 26. *acris*
- LL. Peduncles striate..... 27. *lanuginosus*
- JJ. Sepals reflexed.
- K. Fls. many on a st. 28. *constantinopolitanus*
- KK. Fls. 1 or 2 on a st. 29. *anemonefolius*

1. *Ficaria*, Linn. (*Ficaria Ficaria*, Karst.). Perennial: roots fleshy, thickened: sts. short, decumbent, branched at base, often with bulblets in the lf-

axils: lvs. 1-2 in. long, ovate, cordate, crenate (sometimes entire), somewhat fleshy; petioles long, broad: fls. solitary, golden yellow, about 1 in. across; sepals 3, spreading, oval, concave; petals 8-9, scale at base of petal emarginate: achenes 15-20, in a globose head, very convex, truncate, short-puberulent; receptacle glabrous. April, May. Eu., adventive in N. Amer., Mass. to D.C. B.B. (ed. 2), 2:117. Var. *fiore-pleno*, Hort., is a double-fl. form. Var. *grandiflorus*, Hort., is merely a large-fl. form. J.H. III. 53:371. Var. *ochroleucus*, Hort., is a form with whitish yellow fls., offered in the trade.

2. *fluitans*, Lam. Perennial, aquatic: sts. submersed, usually very long: lvs. submersed, petioled, the lower lvs. often long-petioled, about twice 3-parted, divisions very long-linear, 2-3-cleft, segms. nearly parallel: peduncle tapering, bearing a spreading raceme: fls. large, white; petals often more than 5, broadly obovate, many-veined, contiguous, persistent: achenes obovate, inflated, much rounded at the end laterally, apiculate; receptacle conical, naked. June. Rivers, Eu.

3. *hederaceus*, Linn. (*Batrachium hederaceum*, S. F. Gray). Perennial, semi-aquatic: sts. creeping, rooting at the nodes: lvs. subreniform or rounded-cordate, 3-5 shallow rounded lobes widening to their base and usually entire or notched at the apex, usually opposite and with a black half-moon; stipules various: peduncles usually shorter than the lvs.: fls. $\frac{1}{4}$ - $\frac{1}{2}$ in. across, white; petals very narrow, 3-nerved, distant, sometimes hardly exceeding the calyx; stamens 5-12; style prolonging the nearly straight inner edge of the ovary: achenes few, glabrous, obovate, laterally compressed at the base, inflated or rounded at the top, mucous; receptacle globose, naked. June. Shallow ponds or mud. W. Eu. and naturalized in N. Amer., Newfoundland to S. Va. B.B. (ed. 2) 2:116.

4. *psilostachys*, Griseb. (*R. nyssanus*, Petrov.). Perennial, about 18 in. high, appressed silky pubescent: sts. branched: radical lvs. broadly orbicular, subcordate, deeply 3-parted, divisions cuneate, incise-lobed: fls. numerous, large, shining citron-yellow, 2 in. across; sepals reflexed: achenes in a cylindrical spike, ovate, slightly verrucose, beak straight, as long as the body. Serbia, Macedonia, and Greece. G.C. III. 46:163.

5. *monspeliacus*, Linn. Perennial, 1½ ft. high, white-woolly or sericeous: sts. erect, few-fl.: lvs. woolly, ovate-rotund, cordate, the radical 3-lobed, lobes cuneate, trifid or 3-toothed; the upper 3-parted, lobes entire, linear: fls. yellow; sepals hirsute, reflexed; petals obovate: achenes numerous, pubescent, compressed, beak recurved and equaling the carpel; receptacle glabrous; head of achenes ovate. April, May. Medit. region.

6. *orthorhynchus*, Hook. Perennial, 10-18 in. high, hirsute to nearly glabrous: sts. erect from a fascicled root of thick fibers: lvs. mostly oblong, pinnately compound; lfts. or segms. 5-7, lower commonly short-petioled, usually cleft or incised: fls. yellow, sometimes purple outside; sepals reflexed, soon deciduous; petals 7-16, $\frac{1}{3}$ - $\frac{1}{2}$ in. long, obovate, much surpassing the sepals: achenes in an ovoid head, not numerous, ovate, nearly 2 lines long, strongly margined, beak slender, subulate, rigid, straight, nearly as long as the body. May-July. Wet places, Brit. Col. to Ore. and Mont. Var. *platyphyllus*, Gray (*R. maximus*, Greene), is more robust, growing 1-5 ft. high, the lfts. often 3 in. long, laciniately cleft and incised and the petals often larger than the type. N. Utah, Idaho, Wash. to Calif. and reported from Brit. Col.

7. *asiaticus*, Linn. (*R. orientalis*, Hort., not Linn.). Fig. 3341. Perennial, 6-12 in. high: sts. erect, simple or branched, somewhat appressed hirsute: lowest radical lvs. cuneate-ovate, dentate at the obtuse

apex; the others ternately or biternately cut, segms. ovate or oblong, toothed or deeply trifid, sometimes many-fid: fls. 1-4 to a st., of many various colors; sepals spreading; petals large, obovate, very obtuse, much exceeding the calyx: achenes papery-compressed, oblong, glabrous, attenuate to a much shorter beak which is hooked and black at the tip; head of achenes cylindrical. May, June. S. E. Eu., Asia Minor, Syria and Persia. F.S. 16:1679 (fl.-pl.). G.M. 49:13.—Very variable; the common garden ranunculus of which there are several highly developed strains, many of which are very double. The fleshy roots are sold as



3341. Persian ranunculus.—*R. asiaticus*. ($\times \frac{1}{2}$)

bulbs. The cult. forms of *R. asiaticus* are constantly increasing in number. They are of two main types: (1) The florists' section, called PERSIAN RANUNCULI, or true *R. asiaticus*. These require more care than the others. They are very variable in form and color, and are the most highly cult. members of the genus. (2) The gardeners' section, called TURBAN RANUNCULI, or var. *africanus*, Hort. (*R. africanus*, Hort.). Compared with the first section, these have larger, broader, 3-parted lvs., not so much cut: fls. larger and broader, with many crisp petals, not flat and spreading but erect and curved inward, forming a spherical fl., as in the double peonies. Var. *superbissimus*, Hort., is a taller-growing very large semi-double-fl. form. July-Sept. R.B. 16:133.

8. *cortusæfolius*, Willd. Perennial, 1-3 ft. high, velvety hairy: roots thick, fleshy, fasciated: sts. branched, corymbose above: lower lvs. long-petioled, subcordately reniform, incised lobes cut and dentate; cauline lvs. nearly sessile, 3-5-lobed, lobes narrow; floral lvs. sessile, lanceolate: fls. several to many in a terminal and axillary rather paniculate infl., yellow; sepals 5, ovate to lanceolate, spreading, green with pale margins; petals 5, large, broadly obovate, glossy: achenes compressed, hairy on sides, tapering into recurved beaks, nearly their own length; head of achenes short-ovoid. May. Isl. of Teneriffe, Canary Isls. B.M. 4625. Gn. 45:28. Gn.W. 8:517. J.F. 3:239.—Not very hardy and needs protection in winter and early spring. It is well suited for pot culture. It is increased by division of the roots in autumn.

9. *glaciælis*, Linn. Perennial, 3-6 in. high: sts. reddish brown, 1-3-fl.: lower lvs. petioled, rather fleshy, palmately 3-parted or 3-cleft, lobes trifid, or again lobed, the lobules rather obtuse; the other lvs. similar but sessile and involucre: sepals very hirsute; petals obovate to cuneate, obtuse, white or reddish: achenes very numerous, obliquely obovate, slightly compressed, smooth, glabrous, margin above membranaceous-winged; beak straight; receptacle glabrous. May-Aug. Alpine Eu., Arctic regions, Greenland. Gn. 45, p. 28; 48, p. 501. G.C. III. 53:117.—With age the fls. become coppery red.

10. *Mæthwesi*, Cheesm. Perennial, 15-20 in. high, glabrous or a few weak hairs on the petioles and peduncles: radical lvs. reniform or orbicular ternate-cut, the main divisions petioluled, coarsely toothed or lobed; petioles stout, 3-9 in. long; cauline lvs. sessile, deeply toothed or lobed: fls. 1-4, large, pure white, sweet-scented, $2\frac{1}{2}$ -3 in. across; sepals 5, slightly villous, reflexed; petals numerous, 12-20, oblong-cuneate, rounded at apex; gland solitary, large and basilar: achenes forming an oblong-globose head $\frac{1}{2}$ in. or more diam., turgid, pilose, beak long, subulate. New Zeal. Gn. 78, p. 2.

11. *aconitifolius*, Linn. Perennial, 6 in. to 3 ft. high, pubescent: sts. branched: lvs. palmately 3-5-parted; segms. incise-dentate; upper lvs. sessile with linear-lanceolate lobes: fls. white, several to a st.; sepals flat, glabrous; petals oblong, cuneate or orbicular: achenes 6-15, obovate, laterally subcompressed, nerved, glabrous, beak straight, recurved at the top; receptacle villous. May, June. Mountains of Cent. Eu. Gn. 70, p. 135. G.M. 45:196. Var. *flöre-pleno*, Hort. (*R. aconitifolius* var. *plenus*, Hort.), called WHITE BACHELOR'S BUTTON and FAIR MAIDS OF FRANCE, has large double white fls. Gn. 45, p. 29; 48, p. 506; 65, p. 24. G. 4:415; 10:411; 36:226. Var. *luteo-plenus*, Hort., has double golden yellow fls.—This species and its varieties are well adapted for border planting.

12. *alpéstris*, Linn. Perennial, 3-6 in. high: st. usually 1-fl.: lvs. petioled, orbicular-cordate, 3-lobed, lobes rather obtuse, lobate-crenate at the top, sometimes the lvs. are trifid or hardly so; this is true of the sessile cauline ones: sepals glabrous, spreading; petals 5, white, rounded-obcordate, emarginate: achenes obovate-globose, glossy, glabrous; beak straight, hooked at the summit. Mountains of Eu.

13. *rutæfolius*, Linn. Perennial, 3-6 in. high: st. usually 1- rarely 2-3-fl.: lvs. pinnately cut, lobes 3-lobed, incisedly many-cleft: sepals glabrous; petals 8-10, white, sometimes suffused with yellow toward the base, oblong, claw orange: achenes obliquely ovate, reticulate-rugose, emarginate; beak short and curved. May-Aug. Alpine Eu. and Siberia.

14. *amplexicaulis*, Linn. Perennial, 3-12 in. high: sts. erect, glabrous, with 2-3 flowering branches: lvs. oval-lanceolate, acuminate, amplexicaul, at first with hairy edges soon becoming glabrous, glaucous: fls.

3-6, terminal or axillary, pure white, with yellow stamens; sepals acute; petals much larger, obtuse; achenes in an ovoid head, obliquely globose, faces raised in prominent nerves, beak recurved; receptacle pubescent at base. April-July. Mountains of Eu. B.M. 286 (poor). L.B.C. 16:1593. J.H. III. 35:345; 71:85. G.C. II. 19:788. G.L. 22:95. G.W. 3, p. 217; 15, p. 429.

15. *pyrenaeus*, Linn., also incorrectly offered in the trade as *pyrenaicus*, Hort. Perennial, about 1 ft. high: lvs. linear or lanceolate, entire, all basal, bluish green: scape tomentose at the top, 1-4-fld.; fls. white, rather large; sepals glabrous; petals obovate; achenes obliquely obovate-globose, sides glossy, beak short, hooked; receptacle pubescent. June-Aug. S. Eu.

16. *parnassifolius*, Linn. Perennial, 3-8 in. high: sts. 1-6-fld., hirsute above: radical lvs. long-petioled, rather cordate or ovate-rounded, upper surface shiny



3342. *Ranunculus lingua*. ($\times \frac{1}{4}$)

green, under surface lanate on the nerves; petioles lanate; cauline lvs. sessile, ovate-lanceolate: fls. snowy white or rarely purplish; sepals pubescent, roseate, very obtuse; petals obovate; achenes in a spherical head, obliquely globose, faces glossy; receptacle pubescent. June, July. Alps and Pyrenees. B.M. 386. L.B.C. 3:245. J.H. III. 30:37. Gn.W. 20:275.

17. *insignis*, Hook. f. Perennial, 1-3 ft. high, usually villous: sts. stout and erect, paniculately branched: radical lvs. numerous, large, rounded-cordate or reniform-crenate, often short-lobed, 4-9 in. diam., thick and leathery; petioles short, sheathing at base; cauline lvs. smaller, upper cut and lobed: peduncles often very numerous, stout with linear-oblong bracts: fls. golden yellow, 1-2 in. across; sepals 5, woolly outside; petals 5-6, rarely more, obovate, with 1 or 2 glands at base: achenes forming a rounded head $\frac{1}{2}$ in. diam., swollen, villous, beak long and slender; receptacle oblong, pubescent. New Zeal.—A variable plant, both in size and degree of hairiness.

18. *gramineus*, Linn. (*S. graminifolius*, Salisb.). Perennial, 6-12 in. high: sts. erect, fibrillose at the neck, otherwise glabrous, 1-7-fld.: lvs. lanceolate or linear, entire: fls. yellow, brilliant; sepals glabrous; petals cuneate, scales of the petals tubular: achenes in a head, obliquely obovate-globular, faces reticulate, nerved, beak short; receptacle glabrous. April-June. Eu. and Morocco. B.M. 164.

19. *lingua*, Linn. Fig. 3342. Perennial, 2-3 ft. or more high: roots densely fibrous: sts. erect, glabrous: lvs. 6-10 in. long, lanceolate, acuminate, sessile, semi-amplexicaul, entire or toothed: fls. showy, yellow, about $1\frac{1}{2}$ in. across, somewhat panicked; sepals oval, villous; petals shining: achenes 60-80, in a globose head, compressed, with a straight border which is larger at the top, beak large, short, sword-shaped; receptacle glabrous. June-Sept. Marshes, ditches and pond borders. Eu. and Temp. Asia south to the Himalayas. Gn. 48:500.—Useful for water-gardens and aquatic planting. Var. *grandiflorus*, Hort., apparently differs only in the size of fl.

20. *repens*, Linn. Perennial, stoloniferous: root-stock short and thick; roots fibrous: sts. decumbent, 8 in. to 2 ft. long, more or less appressed hairy: lvs. 3-divided, the terminal segm. or all three petioluled, all ovate, cuneate or truncate, acute, incised-lobed: peduncles sulcate: fls. yellow, about 1 in. across; sepals spreading, hairy below; petals obovate, much longer than the sepals: achenes in a globose head, plano-compressed, ovate-orbicular, beak slightly curved less than half the length of the body; receptacle slightly villous. May-July. Eu., Siberia, N. Amer., Newfoundland to Va., Ont. and Brit. Col., Bermuda and Jamaica. B.B. (ed. 2) 2:113. Var. *flore-pleno*, DC., Fig. 3343, is a double form not uncommon in gardens.

21. *bulbosus*, Linn. (*R. speciosus*, Hort.). Perennial, about 1 ft. high: root a true bulb: sts. erect, hirsute: lvs. petioled, broad ovate, 3-5-parted, terminal division petioluled, lateral sessile or nearly so, all variously lobed or cleft: peduncles sulcate: fls. bright yellow, about 1 in. across, terminating the branches; sepals often reflexed; petals 5-7, much larger than the sepals, obovate, shining above: achenes in a globose head, ovate, compressed, beak very short, bowed; receptacle slightly villous. Eu., Persia, N. Afr., naturalized in N. Amer., New England to N. C., Tenn., and La. B.B. (ed. 2) 2:112.—One of the common field buttercups. Var. *flore-pleno*, Hort. (*R. speciosus flore-pleno*, Hort. *R. speciosus plenus*, Hort.), is a double-fl. form.

22. *Enysii*, T. Kirk. Perennial, 6-15 in. high: root-stock rather stout: sts. slender, glabrous: lvs. all radical, numerous, 1-3 in. diam., 3-5-foliate or biternate; lfts. long-petioluled, toothed, 3-5-lobed or 3-5 narrow cuneate incised, toothed or lobed segms., occasionally pinnately divided: scapes 1-5, longer than the lvs., 1- rarely 2-fld.: fls. yellow, $\frac{1}{2}$ -1 in. across; sepals 5, broadly ovate; petals usually 5, rarely more, broadly obovate: achenes in a small rounded head, numerous, turgid, glabrous, beak stout, straight or curved. New Zeal.

23. *montanus*, Willd. Perennial, about 6 in. high: rootstock short, creeping: sts. pubescent, with soft appressed or spreading hairs, especially toward the top, usually 1-fld.: radical lvs. few, petioled, glabrous, orbicular or pentagonal, palmately 3-parted, segms. obovate, trifid, obtuse, sinus sharp; cauline lvs. 3-5-parted, sessile, somewhat clasping, segms. linear-oblong, divergent, obtuse: fls. bright yellow, terminal, about 1 in. or more across; sepals pubescent, concave, acute, yellowish green; petals 5, large, broadly obovate with a very short scale at base: achenes 20-30, turgid, glabrous, beak recurved, much shorter than the body; receptacle pilose. May-July. Mountains of Eu. B.M. 3022. L.B.C. 17:1610. G. 37:341. Var. *dentatus*, Baumg. (*R. carpaticus*, Herbieh). Lvs. much more

toothed than in the type: plant much taller: fls. larger. B.M. 7266. Gn. 52:262.

24. *polyanthemos*, Linn. Perennial: sts. erect, many-fl., spreading, pilose: radical lvs. broadly ovate-orbicular, palmately 3-5-parted, segms. linear, dentate; petioles spreading, pilose: peduncles sulcate: fls. yellow; sepals villous: achenes prolonged into a very short, somewhat hooked beak. N. and Cent. Eu., Caucasus region.—The common form in cult. is var. *plenus*, Hort., which has a branching infl. of small globular orange fls.

25. *californicus*, Benth. Perennial, 6-25 in. high, pubescent or hirsute: sts. rather weak, branching and naked above: lvs. ternately divided or parted, some pinnately 5-divided, segms. linear or narrow-lanceolate and often 2-3-parted: fls. yellow; sepals closely reflexed; petals 6-15, glossy, oblong or narrowly obovate, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: achenes flattened, only slightly margined, beak short, stout, and closely recurved. Dry ground, Calif. and Ore.—The common species of that region.

26. *acris*, Linn., also spelled *acer* by some recent authors. Fig. 3344. Perennial, 8 in. to 3 ft. high: sts. erect, pubescent, many-fl.: radical lvs. tufted, petioled, palmately 3-7-parted, divisions sessile and cleft; cauline lvs. similar, petioles shorter and sheathing the st.; uppermost only 3-parted, lobes entire, nearly linear: fls. golden yellow, about 1 in. across; sepals spreading, ovate, villous beneath; petals 5, glabrous, glossy, obovoid, obtuse, bearing a prominent scale at the base, much longer than the sepals: achenes in a globose head, coriaceous on the margins, compressed, beak less than half the length of the body. April-Sept. Eu. and naturalized in N. Amer., Newfoundland, Canada and the Atlantic states. B.B. (ed. 2) 2:111. Var. *flöre-pleno*, Hort. (*R. acer flöre-pleno*, Hort.), is a double form which is more common in cult. The most desirable forms are rich glossy golden yellow and very double; known horticulturally as "yellow bachelor's buttons." B.M. 215.

27. *lanuginosus*, Linn. Perennial, villous: sts. tall, erect, many-fl., hairs reflex or spreading, fibrillose at the neck: radical lvs. broadly orbicular-pentagonal, silky pubescent, 3-parted, divisions

broad-obovate, acutely trifid and dentate; petioles with hairs reflex or spreading: peduncles striate: fls. yellow; sepals spreading, villous: achenes plano-compressed, obovate, marginate, beak one-third as long as the body, hooked; receptacle glabrous. July. Eu. and Caucasus region. Var. *flöre-pleno*, Hort., is a double form, which is the one usually cult.

28. *constantinopolitanus*, Urv. Perennial: sts. erect, retrorse villous, corymbosely many-fl.: lvs.

long-petioled, appressed, silky, broadly triangular-ovate, trifid or 3-parted, divisions ovate, acutely lobed and dentate; petioles retrorse villous: peduncles terete: fls. yellow; sepals reflexed: achenes plano-compressed, suborbicular, marginate, beak one-third to one-fourth as long as the body, coiled to hooked, rising abruptly.

Turkey. Var. *palæstinus*, Boiss. (*R. palæstinus*, Boiss.). Lvs. 3-parted, divisions divergent from the base, cuneate-oblong, 2-3-cleft. Palestine and Syria. There

is a form of this known horticulturally as *R. palæstinus atrococcineus*, with large intense scarlet fls., borne on long peduncles. Palestine.

29. *anemonefolius*, DC. Perennial, scarcely 1 ft. high: sts. erect, 1-2-fl., somewhat fibrillose at the neck otherwise glabrous below, appressed-pubescent above: radical lvs. pubescent, broadly orbiculate, sometimes 3 in. diam., 3-parted, divisions cuneate, deeply trifid, segms. acute, dentate; cauline lvs. few, divided into

3344. Buttercups.—*Ranunculus acris*. (Natural size)

linear segms.: fls. large, yellow; peduncles finally striate: young achenes obovate, compressed, beak hooked, one-sixth the length of the body. Asia Minor.

R. addoneus, Gray, 4-12 in.: shaggy-hairy: sts. more or less decumbent: fls. golden yellow. Colo.—*R. anemonoides*, Zahl., 6 in.: fls. white or tinged rose. Austria. Gn. 22:252. J.H. III. 54:345. —*R. aquatilis*, Linn., sometimes called lodewort, ram's foot, etc., is an interesting aquatic plant common in temperate regions, the floating lvs. often broad and 3-lobed, while the submerged lvs. are cut up into numerous thread-like segms.—*R. Arénalis*, Hort. (*R. amplexicaulis* X *R. gramineus*), has fls. of a soft shade of butter-yellow, fading white, and like partial shade and a moist situation, according to trade-lists.—*R. bulbatus*, Linn., is a yellow-fl. species offered in single and double forms by Dutch bulb-dealers. Medit. region.—*R. cardiophyllus*, Hook., offered in Colo. in 1900, is considered by Gray as *R. affinis* var. *validus*. It is an American species pictured in B.M. 2999 with yellow fls. $1\frac{1}{4}$ in. across.—*R. fascicularis*, Muhl. Height 1 ft. June. N. Amer. Mn. 2:1.—*R. Lyallii*, Hook. f., the New Zealand water-lily, grows 2-4 ft. high, has peltate lvs. and waxy white fls. 4 in. across, borne in many-fl. panicles. In Eu. it is considered a cool greenhouse plant. It is a gorgeous species and ought to succeed somewhere in N. Amer. G.C. II. 15:724; 23:371; III. 51:suppl. June 29. Gn. 67, p. 23; 74, p. 379.—*R. pedatus*, Waldst. & Kit., a native of the Hungarian Alps, has yellow fls. nearly an inch across.—*R. septentrionalis*, Poir., has been listed; a native plant allied to *R. repens*.—*R. spectabilis plenus*, Hort., has been offered as a dwarf plant with double shining yellow fls. This species is unknown botanically.—*R. spicatus*, Deaf., is figured in B.M. 4585 with showy 5-petaled yellow fls. fully 2 in. across. It is an Algerian species but is said to be perfectly hardy in England and of easy cult. in any good garden soil. J.F. 2:148.—*R. Süsdorffii*, Gray, 4-10 in.: st. slender, 1-3-fl.; fls. deep yellow. Mountains Wash., Ore. and Mont.—*R. superbissimus*, Hort., is used in some catalogues for the double French ranunculi, known also as *R. asiaticus* var. *superbissimus* (No. 7).—*R. viridiflorus*, Hort. Van Tubergen, is a scarlet-and-green-fl. variety of the Turban class of *R. asiaticus*.

F. TRACY HUBBARD.

RAPE (*Brassica Napus*). Fig. 3345. In recent years rape has become an important forage plant. The name rape includes several varieties which are grown for two purposes: (1) for seed from which oil is expressed;



3343. *Ranunculus repens*, double-flowered. Tip of a decumbent plant, which roots at the joints. ($\times\frac{1}{4}$)



(2) for the purpose of furnishing animals with succulent feed during late summer and autumn, when pastures become bare. Varieties used for the latter purpose usually do not produce seed in this climate the same season, though they are usually classed with annuals. Dwarf Essex is an example of the kind used for soiling (green feeding) purposes. Rape is of considerable importance to the fruit-grower as a cover-crop. The seed germinates readily, will often grow where a clover catch is impossible, and furnishes excellent sheep pasture late in the season. When grown strictly as a



3345. Dwarf Essex rape. ($\times \frac{1}{2}$)

soiling plant, the tops are cut and hauled to the feed-lot or stable. Dwarf Essex rape much resembles a rutabaga turnip at first. It is like a rutabaga with an exaggerated leafy top and without a swollen fleshy root. Rape is a cool-weather plant and may be grown in almost any part of the United States by sowing it at the proper time. As a cover-crop in the orchard in the East it may be sown as late as September 15 with good results. It is an excellent pioneer plant in the work of renewing humus in worn-out lands. In the Middle West, where shade is needed, rape is used as a nurse plant for clover when the latter is sown in orchards in midsummer. Turnips may be used for the same purpose.

JOHN CRAIG.

RAPHANUS (classical name, from the Greek). Sometimes spelled *Rhaphanus*. *Cruciferae*. Annual or biennial branching herbs, one of which, *R. sativus*, is the radish (which see).

Leaves various and variable, the radical and sometimes the cauline lyrate-pinnatifid: fls. small but rather showy, slender-pedicelled, in open terminal racemes, rose-lilac or white, or in some species yellow; sepals erect, the lateral ones somewhat saccate or pouch-like at base; stamens 6, free: pod a long-cylindrical fleshy or soft-corky silique, with spongy tissue between the globose seeds, indehiscent.—About 10 species in Eu. and Temp. Asia. The genus is divided into two natural groups, one (*Raphanistrum*) with the pod longitudinally grooved and constricted between the seeds, the other (*Raphanus* proper) with the pod not grooved nor prominently constricted. To the former group belongs *R. Raphanistrum*, Linn., the JOINTED or WHITE CHARLOCK (sometimes, but erroneously, known as RAPE). It is an Old-World annual weed, now naturalized in fields and waste places in the easternmost states. It is an erect sparsely hairy herb, with slender tap-root and radish-like lvs., growing 2-3½ ft. high: fls. rather showy, yellowish, turning white or purplish: silique 1-3 in. long, few-seeded, with a long beak. It is from this species that Carrière produced radishes by means of plant-breeding (see *Radish*). To the second section belongs *R. sativus*, Linn., the RADISH, considered to be native to Eu. and Asia, but imperfectly known in an aboriginal wild state. It is usually annual, although commonly spoken of as biennial because the roots can be kept over winter and planted the following spring. The winter radishes are truly biennial in northern climates. Radish has pink-lilac or nearly white fls., and short thick spongy taper-pointed pods. Sometimes it runs wild in waste places, and then bears a long hard tap-root like that of *R. Raphanistrum*. The radish is extensively cultivated for its thick root, which has been developed into many shapes and colors. There are Chinese types of radish that have hard roots

little more than 1 in. diam., and sometimes becoming nearly 1 ft. long. Some forms are scarcely distinguishable from short turnips. The Madras radish (India) is grown for its soft tender pods, which are eaten raw or in pickles. The rat-tailed or serpent radish, var. *caudatus* (*R. caudatus*, Linn.), has enormously long pods (see Fig. 3346), which are eaten either pickled, or raw as are radish roots. Frequently the pods are 1 ft. long. The root is slender and hard. This is a cultural variety, coming true from seed.

L. H. B.

RAPHIA (Greek, *needle*, referring to the fact that the fr. ends in a noticeable point). *Palmaceae*. Monocarpic palms unarmed or with the sheaths only armed: sts. erect, simple or dichotomously branched, densely annulate: lvs. in a terminal crown, equally pinnatisect; lfts. linear-lanceolate, acuminate, rachis not produced at the apex: spadices monœcious, large, pendulous, cylindrical, much-branched; the branches and branchlets thick, compressed, the latter pectinately arranged, densely covered with cup-shaped bracts; common spathe none: fls. solitary in each bract, the male at the base of the ultimate branches of the spadix, the female at the apex; calyx tubular, entire or minutely toothed; corolla curved, the petals 3, linear-lanceolate, valvate; stamens 6-16: fr. large, oblong or ellipsoid, rostrate, 1-seeded.—About 15 species, Trop. Afr. and the Mascarene Isls., 1 in Trop. Amer. *R. Gentiliana*, Wildem. Lvs. pinnate, furnished with small prickles: infl. dense, pendent, nearly 3 ft. long with flattened branches, the principal rachis of the branches with imbricate bracts: fr. pyriform, apiculate, 2-2½ in. long, with 9-10 rows of fringed scales. Congo. *R. Laurentii*, Wildem. Trunk up to 6 ft.: lvs. 15-40 ft. long; rachis subcylindrical, about 3 in. thick, grooved; lfts. irregularly disposed, linear, up to 5½ ft. long and 2 in. broad, acute, with short blackish spines: infl. compact, branched, more than 3 ft. long: fr. ovoid, about 2 in. long, short-peduncled, with 12 rows of scales. Congo. R. B. 32, pp. 14-16. *R. Ruffia*, Mart. RAFFIA or ROFFIA PALM. Trunk 6-26 ft. high: lvs. up to 65 ft. long, petiole up to 13 ft. long, nearly 1 in. thick: fr. obovate or pyriform, somewhat depressed and mucronate at the apex, 12-15 rows of very convex scales. Trop. Afr. and Madagascar. *R. tadijera*, Mart. Trunk 6-8 ft. high: lvs. 50 ft. or more long, bending out and often forming a graceful plume 70 ft. high and 40 ft. diam.: fr. oblong, 2½ in. long, reticulated with large scales. Amazon. Probably also produces raffia. *R. vinifera*, Beauv. BAMBOO or WINE PALM. Trunk of medium



3346. Rat-tailed radish.—*Raphanus sativus* var. *caudatus*. Grown for its enormous pods. ($\times \frac{1}{2}$)

height: lvs. 6-7 ft. long; lfts. spiny; spadix about 8 ft. long, laxly branched; fr. cylindric-ellipsoid, shortly mucronate, 3 in. long, 8-9 rows of deeply grooved scales. Trop. Afr.—The natives make wine from the sap of the trunk and which they call "bourdon."

F. TRACY HUBBARD.

RAPHIOLEPIS (Greek, *raphis*, needle, and *lepis*, scale; referring to the subulate bracts). Sometimes spelled *Rhaphiolepis*. *Rosaceae*, subfamily *Pomeae*. Ornamental shrubs grown for their handsome foliage and attractive white or pinkish flowers.

Leaves persistent, alternate, short-petioled, serrate, rarely entire: fls. in terminal racemes or panicles; sepals triangular; petals 5, oblong or obovate; stamens 15-20; ovary completely inferior; styles 2-3, connate toward the base: fr. subglobose, purplish black or bluish black with 1 large subglobose or 2 partly compressed seeds.—Two or perhaps 4 species in S. Japan and China.

These are handsome evergreen shrubs with alternate or obscurely whorled leaves, white or slightly pinkish flowers and small pea-sized black fruits. None of the species is hardy North, but *R. umbellata* will stand about 10° of frost or even more with some protection; they are well suited for cultivation in the southern states and California. They will thrive in any good well-drained soil, and if cultivated in pots, a compost of sandy loam and leaf-mold or peat will suit them. Propagation is by seeds or by cuttings of ripened wood under glass late in summer; also by layers, and sometimes grafted on hawthorn.

umbellata, Schneid. (*R. japonica*, Sieb. & Zucc.). Shrub, to 12 ft., with stout upright branches: lvs. short-petioled, elliptic to broadly oval or obovate, obtuse or acutish, narrowed at the base, crenate-serrate, dark green and lustrous above, pale beneath, floccose-tomentose when young, thick, 1½-3 in. long; fls. white, ¾ in. across, fragrant, in dense, tomentose panicles or racemes; petals obovate, obtuse: fr. to ½ in. across. May, June. S. Japan and adjacent islands. S.Z. 1:85. Gn. 22, p. 43; 32, p. 20; 34, p. 158. G. 7:165; 10:224. Var. *ovata*, Schneid. (*R. ovata*, Briot). Lvs. broadly obovate, rounded at the apex. R.H. 1870, p. 348. G.W. 4, p. 129; 14, p. 323. J.H. III. 47:521; 69:81. Var. *integerrima*, Rehd. (*R. japonica* var. *integerrima*, Hook.). Lvs. entire or nearly so, broadly obovate. B.M. 5510.

indica, Lindl. (*R. rubra*, Lindl. *Crataegus indica*, Linn.). INDIAN HAWTHORN. Shrub, to 5 ft., with slender spreading branches: lvs. obovate to oblong-lanceolate, acute or acuminate, gradually narrowed at the base, serrate, glabrous or slightly pubescent when unfolding, 1½-2½ in. long; fls. white or pinkish, about ½ in. across, in glabrous or somewhat tomentose, rather loose panicles; sepals lanceolate, acute, usually red like the filaments; petals acute: fr. ¼-½ in. across. May, June. S. China. B.M. 1726. B.R. 1468; 1400 (as *R. rubra*). L.D. 4:247 (as *Crataegus sinensis*).—A very variable species; several forms have been described as distinct species, as *R. Phaeostemon*, *R. rubra* and *R. salicifolia*, Lindl. The last named, which is var. *salicifolia*, Nichols., is the most ornamental: lvs. oblong-lanceolate, acuminate: panicles rather large and many-fl.; stamens white or purplish, shorter than sepals. B.R. 652. R.H. 1874:270. Gn. 9:596.—A hybrid between *R. indica* and the preceding species is *R. Delacourii*, André, forming a compact shrub with rather large panicles of blushed fls. and the foliage intermediate between the two parents. R.H. 1900:698.

ALFRED REHDER.

RAPHIONACME (Greek, *needle* and *point*, referring to the 5 pointed or awned scales in the throat of the corona). *Asclepiadaceae*. Herbs, with tuberous root-stock often furnished with an elongated woody neck; juice milky: lvs. opposite: fls. small or moderate-sized,

terminal in few- or many-fl. cymes, or in the forks of the st., or subaxillary from one axil, rarely from both; calyx 5-parted; corolla-tube distinct, campanulate, lobes 5, erect, spreading or reflexed; crown of 5 free, entire, 2-3-divided or 3-parted lobes alternating with the corolla-lobes: follicles often solitary by abortion.—About 35 species, Trop. and S. Afr. *R. utilis*, N.E. Br. & Stapf. Perennial herb with a turnip-shaped tuber 2-5 in. diam., covered with dark brown flaky bark: sts. annual, 1-4 in. long, erect or decumbent: lvs. in 2-5 pairs, opposite or forming a rosette close to the ground, orbicular, elliptic or oblong-ovate, obtuse and apiculate or subacute at the apex, rounded or subcordate at base, green above, purple beneath: fls. in small terminal and axillary cymes or clusters, bright purple; sepals lanceolate, acute, purplish with green tips; corolla about ½ in. diam., deeply 5-lobed. Trop. Afr. B.M. 8221.

F. TRACY HUBBARD.

RAPHIS: *Rhaphis*.

RAPHISTEMMA (Greek, *needle* and *crown*, referring to the linear scales of the crown). Glabrous twining shrubs: lvs. opposite and membranaceous: infl. long-peduncled, axillary, umbelliform cymes; fls. large, white, and long-pedicelled; calyx 5-glandular inside; corolla campanulate, 5-cleft, lobes spreading, twisted in bud and overlapping to the right; crown with 5 membranaceous scales which are produced into long slender linear ligules: follicles thick, acute, smooth.—About 2 species, Asia. *R. pulchellum*, Wall. Branches slender, smooth, and herbaceous: lvs. cordate-acuminate, 3-7 in. long: cymes 4-6-fl.; the pedicels very slender: fls. pure white, 1-1½ in. long; sepals broad; corolla thick. Himalaya region and Burma. J.F. 4:353.

RASPBERRY (from *rasp*, a tool resembling a file, and berry), a name applied to certain species of the genus *Rubus*, particularly to *Rubus idaeus*, *R. strigosus*, and *R. occidentalis*, from which have been derived common cultivated forms grown for their excellent edible fruits.

Raspberry plants have perennial roots and erect or nearly erect biennial canes bearing thimble-shaped red, yellow, black, or purple-colored fruit consisting of many cohering drupelets which separate from a partially dried receptacle. The raspberry is distinguished from the blackberries and dewberries, which belong to the same genus, in bearing fruit that separates from its receptacle, while that of the blackberries and dewberries does not separate from their juicy receptacles.

Origin of horticultural varieties.

The first raspberries introduced into cultivation in America were varieties of European origin belonging to the species *Rubus idaeus*. These varieties, adapted to a mild humid climate, did not prove sufficiently hardy to merit their continued cultivation after hardy native varieties of good quality began to be propagated. At present but two varieties, the Antwerp and Superlative, representing the European species, *Rubus idaeus*, are grown commercially. These two varieties are raised only in the Pacific Coast region and are there being gradually superseded by American varieties.

By far the greater part of the varieties under cultivation at present belong to the American species *Rubus strigosus* and *R. occidentalis*. The American red raspberry, *R. strigosus*, is very similar to the European species, *R. idaeus*. Both species have erect canes, but the American species has proved much hardier and adapted to a wider range of environmental conditions. Two of the first varieties of this species to come under cultivation were the Marlboro and Cuthbert, and these are still two of the most widely grown varieties. The black raspberry, *R. occidentalis*, has recurved canes which are longer than those of either of the red-fruited

species, and bears black fruit. The acreage of this class is, at present, much less than that of the red raspberry. The Gregg, one of the first varieties of this species introduced into cultivation, is also one of the leading varieties grown at present.

Yellow-fruited varieties have come from both the American species, the erect-growing sorts from *R. strigosus*, and those with recurved canes rooting at the tips from *R. occidentalis*. Purple-caned varieties, of which the Columbian is the most widely grown, are hybrids between *R. strigosus* and *R. occidentalis*.

Up to the present time, the greater part of the varieties under cultivation have appeared as chance seedlings. Recently, however, many promising new varieties have been originated as a result of systematic effort to produce better sorts. Thus, as the result of definite breeding work, the New York State Experiment Station has originated the June red raspberry, and the South Dakota Experiment Station the Ohta and Sunbeam red raspberries. These, as well as other experiment stations, have many promising varieties under test. L. E. Wardell, a practical grower of Marlboro, New York, has originated the Empire red raspberry, another promising variety. Many others are also trying to originate better varieties, some of whom are using in their work foreign species recently introduced into this country.

Geographical distribution.

The limit of the successful culture of this fruit corresponds closely with the distribution of its wild forms. The southern limit is southern Virginia, along the mountains to northern Georgia, southern Tennessee, westward through the Ozark Mountains and southern Oklahoma. It is chiefly grown in northern regions. The great commercial centers of the industry are, at present, in New York State and Michigan. Smaller centers of its culture, aside from the proximity of the large cities, are found near Hagerstown in western Maryland; in central New Jersey; near Kansas City, Kansas; about Loveland, Colorado, and in the Puyallup Valley of Washington. The culture of the raspberry, however, is not confined to these centers, but is widely distributed throughout the northern districts.

Propagation.

The red varieties are propagated by the use of suckers which spring from the underground parts. Nur-

serymen secure their stock by digging in the spring suckers sent up during the previous summer. Some growers who wish to increase their own plantation wait until young suckers begin to come up in the spring and transplant these. The black raspberries, as well as the purple varieties now raised, are propagated by encouraging the tips of the young canes to root. As the young canes bend over and the tips approach the ground, soil is thrown over the tips. Plants suitable for setting the following spring will be formed during the remainder of the growing period by these rooted tips. By pinching back the tips in early summer when the canes are about 2 feet high, they will branch and several plants may be secured from each cane.



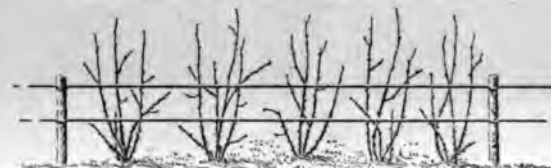
3347. Raspberries trained to the hill system.



3348. Raspberries trained to the solid-row system. No support used.



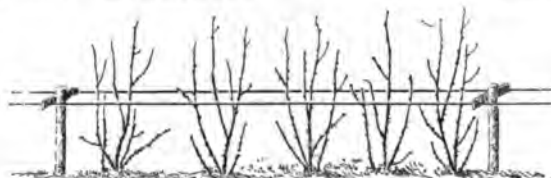
3349. Raspberries trained to a single wire trellis.



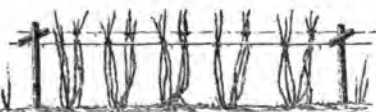
3350. Raspberries trained to the two-wire trellis.—Canes in erect position.



3351. Raspberries trained to the two-wire trellis. Canes arched over upper wire and tied to lower wire.



3352. Raspberries trained between the two wires of a horizontal trellis.



3353. Raspberries trained between the two wires of a horizontal trellis, one-half of canes tied to the wire on one side and one-half to the wire on the other side.

Culture.

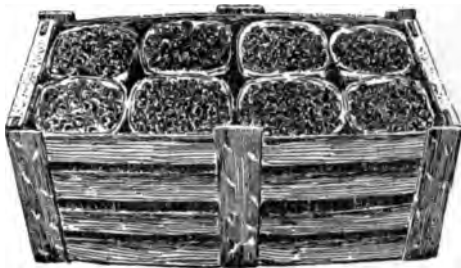
The raspberry thrives best in a deep fertile loam containing plenty of humus. Most varieties grow better on the heavier than on the lighter types of soil, though this is not universally true. The soil must be well drained and a location with good air-drainage should be preferred to lowlands, as certain varieties are peculiarly susceptible to poor air-drainage. Fertilizers are not generally used on raspberry fields, and among growers using them their composition varies widely. The use of fertilizers should depend on the needs of the particular soil, and such needs can be determined only by actual tests of the soil with varying amounts and kinds of plant-foods.

Two methods of culture are commonly used, the hill system and the solid-row system. Under the first system the plants are usually set 5 feet apart each way, while under the second system they are set 3 or 4 feet apart in the row, the rows being from 6 to 8 feet apart. Under the hill system less hand-labor is required for the returns in fruit than under the solid-row system. The plants should be set as early in the spring as possible, as the moisture conditions are usually better in early spring. In setting the plants, the principal requirement is that the soil shall be thoroughly firmed about the roots. Vegetable intercrops may be grown between the rows during the first season and should help pay the cost of cultivation for the first year. Cabbage, cauliflower, beans, peas, and lettuce are often used for this purpose. Cultivation should be thorough and frequent, not only the first year, but after the plantation comes into bearing. Especially when the berries are growing

and ripening do the plants need the large supply of moisture that frequent cultivation conserves.

Training and pruning.

In training the red raspberries when the plants are set by the hill system, a stake is usually placed by each plant before the second year's growth begins and the year-old canes tied to it (Fig. 3347). This allows the new canes to grow up outside the old ones and makes picking easier. When the solid-row system is used, several methods of training are practised. (1) When the plants are vigorous but do not grow very tall, the suckers are allowed to grow up between the plants in the row, while those between the rows are destroyed by frequent cultivation (Fig. 3348). No pruning is required. (2) When the canes grow very long, they are not pruned until spring and then are sometimes cut back to a height of about 3 feet in order that the cane may support its crop of fruit. Weaker canes are removed at this time. (3) Instead of cutting the canes back as described above, they are often trained to trellises in the following ways: (a) A trellis is made by stretching a wire on posts set about 30 feet apart in the row. The old canes are tied to this wire to keep them upright when ripening their fruit (Fig. 3349). Two wires, one above the other, are sometimes used in making this kind of trellis and the canes either tied in an erect position to both wires (Fig. 3350), or they are arched over the upper wire and tied to the lower (Fig. 3351). When tied in an erect position, those portions of the canes projecting more than 6 inches above the wire are pruned off. (b) The trellis is often made by stretching two wires along the line of posts from the ends of crosspieces about 15 inches in length (Fig. 3352). The old and new canes are kept between the wires and out of the way when the cultivating is done. Sometimes the old canes are tied to the wires, half of them being tied to the wire on one side and half to the wire on the other side (Fig. 3353). The young canes then come up between the old canes and will be out of the way of pickers and cultivators. Many variations of the above systems are in use.



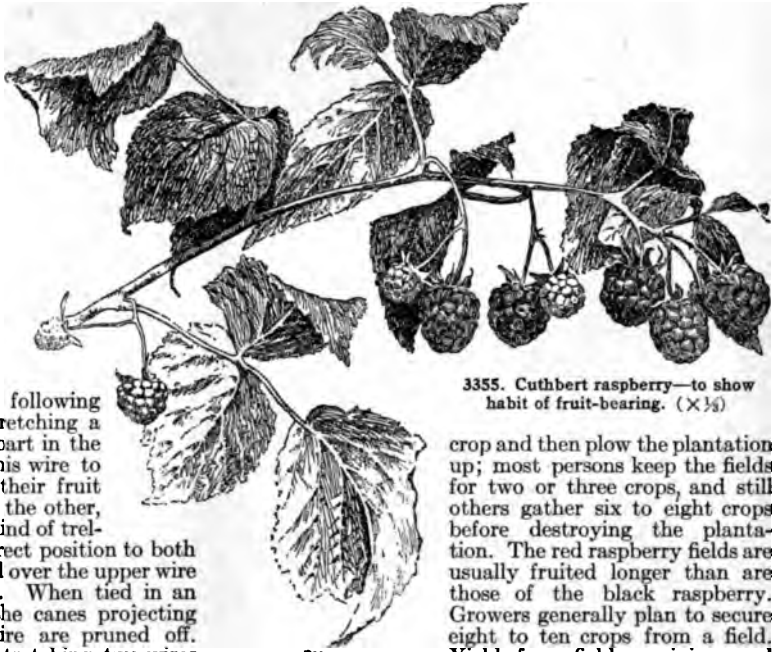
3354. Crate of Cuthbert red raspberries.

The above systems are applicable to the red raspberries. The black and purple varieties do not sucker and are usually trained as follows: The tips of the young canes are pinched back when they are about 2½ feet from the ground. This causes them to branch and form bushes better able to support a heavy crop of fruit. If the side branches grow very long, they are pruned back in the spring to a length of 6 to 18 inches. Sometimes a trellis is made and they are trained on the system

described above under (a).

The old fruiting canes of all types of raspberries should be cut out and taken from the field immediately after the crop is picked. Some fruit is usually secured the second year after planting, often enough to pay the entire cost of cultivation for that year. The duration of the plantation depends on the varieties, the care, the locality, and the practice of the grower.

Some growers of the black raspberries harvest one



3355. Cuthbert raspberry—to show habit of fruit-bearing. ($\times \frac{1}{2}$)

crop and then plow the plantation up; most persons keep the fields for two or three crops, and still others gather six to eight crops before destroying the plantation. The red raspberry fields are usually fruited longer than are those of the black raspberry. Growers generally plan to secure eight to ten crops from a field. Yields from fields receiving good treatment will vary from 50 to 150 bushels to the acre, depending upon the locality, the soil, and the variety grown.

In many northern and western sections, varieties are grown that require winter protection. This is best secured by drawing the soil from one side of the row of plants, using either hoes or a plow, inclining the canes to that side, and covering them entirely with earth about 2 inches deep. The canes are left as late as possible in the spring before uncovering. When the buds begin to start, the canes are forced into an erect position.

Picking and handling.

Raspberries should be harvested as carefully as possible in order to avoid injuring them. The subsequent behavior of the berries on the market depends in a large measure on the care used in picking and handling. Berries injured or bruised in handling, or soft from being over-ripe, or from rainy weather, are quickly attacked by certain mold fungi which cause their decay. To avoid as much injury as possible, three fingers should always be used in picking; very few berries should be held in the hand at one time, to avoid mashing them; the berries should always be placed, not dropped, into the basket or cup; all decaying, over-ripe, and injured berries should be discarded and no later handling of the berries in the baskets allowed. The crates should be hauled on spring wagons to avoid jolting and neither the berries nor the crates containing them should be exposed to the sun. Pint baskets should be used in harvesting red varieties and either pint or quart baskets for the black and purple varieties. (Fig. 3354.) In Pacific Coast regions a basket, or "cup" as it is called there, holding a pound of berries, is commonly employed.

Varieties.

The principal red varieties grown at present are Cuthbert (Fig. 3355). Herbert, King, Marlboro, Ranere (St. Regis), and Perfection (Fig. 3356). Promising new varieties are June, Empire, Sunbeam, and Ohta. Much interest has recently been shown in the fall-bearing



3356. Perfection raspberry trained to stakes 5 by 5 feet apart.

type represented by the Ranere. Among the black raspberries, the Cumberland, Farmer, Gregg, and Kansas are the leading varieties. The Golden Queen is the principal yellow sort grown. The Columbian is the principal purple-caned variety at present, although the Shaffer (Fig. 3357) and Cardinal are also grown. The Royal is a very promising new purple-caned sort.

Enemies.

Among the more serious diseases of the raspberry are crown-gall, anthracnose, cane-blight, and orange-rust. When plants free from these diseases are set, very little trouble is likely to be experienced later from them. The means of control commonly employed when these diseases are found are eradication and destruction of plants affected by crown-gall and orange-rust, and the cutting out and removing from the field of all canes affected by anthracnose and cane-blight. Cane-borers are considered the most serious insect enemy of the raspberry. The adults lay their eggs in the tips of the canes. When these tips are seen to be withering and drooping, they should be cut off and burned. If the cut is made well below the point of injury, these tips will contain the eggs or young larvæ of the borer.

GEORGE M. DARROW.

RATHBUNIA (named for Richard Rathbun, Assistant Secretary in charge of U. S. National Museum). *Cactaceæ*. Plants not large, the st. and branches often weak: spines stout, those of the flowering areoles not differing from the others: fls. diurnal, single, only from the upper areoles, very narrow and elongated, at first straight, but in age more or less curved, oblique at throat, scarlet, persistent; petals very short, spreading or reflexed; stamens attached near the middle of the tube, exserted: fr. spiny, globular, red, breaking open irregularly; pulp red; seeds black, compressed, minutely pitted, with a large basal oblique hilum.—Three species have been described. Native of the west coast of Mex. The species all have rather weak sts., often clambering and resembling somewhat *Cereus serpentinus*, but usually stouter and with different spines and fls. The fls. are very narrow and scarlet, and more enduring.

alamosensis, Brit. & Rose (*Cereus alamosensis*, Coult.). Upright, columnar, about 4 ft. high by 2 in. diam.: ribs 7-9; spines numerous, stout; central spines usually 4: fls. from the upper areoles, funnelliform, about 1½ in. long, red. W. Mex.

R. sonoriensis, Brit. & Rose, and *R. Kerberi*, Brit. & Rose, are sometimes confused with the above, and may be handled under this name in the trade.

J. N. ROSE.

RAUWOLFIA (named for Leonhart Rauwolf, a physician of Augsburg in the sixteenth century). *Apocynaceæ*. Trees or shrubs, mostly glabrous, sparingly grown, suitable for the greenhouse and outdoor planting in the far southern parts of the United States.

Leaves opposite or verticillate, those of a whorl often very unequal: infl. terminal or pseudo-axillary, peduncled, few- or many-flid., compound, umbelliform or corymbose, rarely racemose; fls. small; sepals 5, almost free or united into a flat 5-toothed cup; corolla salver-shaped, lobes 5, twisted and overlapping to the left; disk annular or cup-shaped, entire or slightly lobed; carpels 2, free or more or less coherent: drupes 2, distinct or somewhat united.—About 60 species from the tropics of both hemispheres.

chinensis, Hemsl. A small evergreen shrub, with dark green lvs., white fls. which are borne in dense terminal trusses, and numerous red berries. China.—Intro. into Orange Co., Fla., as an ornamental, where it is semi-hardy, but always sends up strong new shoots in the spring. Requires a light rich soil and plenty of water, with some protection against the sun. Each spring, it should receive fresh rich compost.

pleiosciadica, K. Schum. A shrub or small tree, up to 20 ft. high: lvs. in whorls of 3 or 4, lanceolate to elliptic, 3-7 in. long: fls. in cymes, arranged in umbels, white; corolla-tube 3-3½ in. long. Trop. Afr.

F. TRACY HUBBARD.

RAVENALA (the name of the plant in Madagascar). *Musaceæ*. Musa-like plants becoming 20 to 30 feet high, with a palm-like trunk, cultivated for ornamental uses.

Leaves exceedingly large, crowded in 2 ranks, thus forming a fan-shaped head of foliage; petioles long, with concave bases scarcely sheathed: scapes or peduncles in the upper axils longer or shorter than the lvs.: bracts spathe-like, many, boat-shaped, acuminate: fls. many, large, in a spathe or bract; petals long-exserted; sepals free: fr. a 3-valved caps.—A genus of 2 species, 1 from Madagascar and the other from Brazil and Guiana.

A. Lvs. shorter than petioles.

madagascariensis, J. F. Gmel. TRAVELERS' TREE, so called from the clear watery sap in the large box-like cells of the lf.-stalks or caught in the lf.-sheaths, and which affords a refreshing drink. Fig. 3358. Lvs. often 30 ft. high, very large, fibrous: fls. white, in spathe about 7 in. long. Gng. 5:153. V. 23, p. 136. F.S. 21:2254. A.F. 12:535. R.H. 1890, p. 152. G.C. III. 2:693; 50:460. A.G. 20:870.—Cult. in Fla. and S.



3357. Shaffer raspberry.—*Rubus neglectus*. ($\times \frac{1}{4}$)

Calif.; also rarely under glass in the northern states. It is said that in S. Calif. the traveler's tree was never really successful.

AA. Lvs. as long as the petioles.

guyanensis, Steud. Becoming 15 ft. high: lvs. oval-elongated: fls. white; spathes 1-1½ ft. long.—Offered 1893 in S. Fla.

F. W. BARCLAY.

RAVENIA (name not explained). *Rutaceae*. Tender glabrous shrubs suitable for the warmhouse.

Leaves opposite, 1-3-foliolate; lfts. lanceolate, entire: fls. red or white, borne on rather long axillary peduncles; sepals unequal, the 2 outer being somewhat foliaceous; corolla-tube straight, rather long; the limb nearly regular.—Two species from Cuba and Brazil.

spectabilis, Griseb. (*Lemonia spectabilis*, Lindl.). Tender shrub: lfts. 3: fls. purplish red, about 1 in. across, solitary or in open, few-fl. clusters on axillary peduncles as long as the lvs. Cuba. B.R. 26:59. R.H. 1844:25.—The plant once offered in Fla. as *Lemonia spectabilis* apparently is of some other genus. F. W. BARCLAY.

REBUTIA (named for Rebut). *Cactaceae*. Plants very small, globular, covered with small tubercles, resembling in habit very much a mammillaria: fl. appearing from the side and even the base of plant, large in comparison with the plant, red or orange-colored, with slender, funnel-form tube; bracts on ovary small, naked in their axils: fr. a small berry.—Originally described with 1 species, but a study of S. American material indicates that there may be 5 or 6 other species to be transferred here from other genera. The original species has been referred both to *Echinopsis* and *Echinocactus*, from both of which it is abundantly distinct.

minúscula, Schum. Plants globose, 1-2 in. diam., covered with low tubercles: spines in clusters of 25-30, 1-1½ lines long: fls. often numerous, arising from near the base of plant, 1-1¼ in. long, bright crimson. N. Argentina. B.M. 8583 (as *Echinocactus*).

Fiebrigii, Brit. & Rose (*Echinocactus Fiebrigii*, Gürke). Globose, depressed at apex, 2 in. diam.: spines 30-40 in a cluster, ½ in. long, white, or some of the longest ones nearly 1 in. long with brownish tips: fls. nearly 1 in. long. Bolivia. Blühende Kakteen, pl. 109.

J. N. ROSE.

RED BAY: *Persea Borbonia*. **Red-Bud**: *Cercis*. **Red Campion**: *Lychnis dioica*. **Red Cedar**: *Juniperus virginiana*. **Redhead**: *Asclepias curassavica*. **Red-hot Poker Plant**: *Kniphofia*. **Red Morocco**: *Adonis autumnalis*. **Red Osier**: *Cornus stolonifera*. **Red Pepper**: *Capsicum*. **Red Robin**: *Geranium Robertianum*. **Red-root**: *Ceanothus americanus*; *Lachnanthes*. **Red-Spider**: See *Diseases and Insects*. **Redtop**: *Agrostis*. **Redwood**: *Sequoia*; also *Ceanothus*, *Pterocarpus*.

REED: *Arundo* and *Bamboo*. **R. Canary-Grass**: *Phalaris arundinacea*. **R., Indian**: *Canna*. **R. Mace**, or **Cat-tail**: *Typha*.

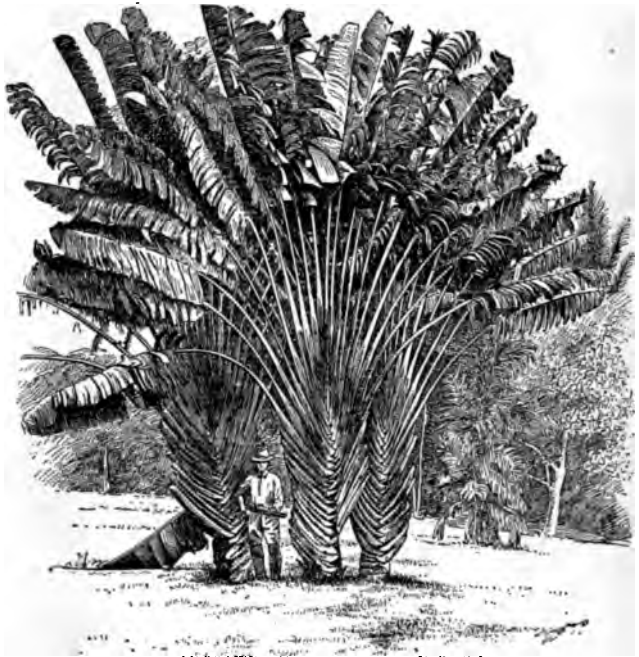
REEVÈSIA (after John Reeves, an English resident of Canton, China, who introduced many Chinese plants into England). *Sterculiaceae*. A genus of 3 species in China and Himalayas. Evergreen trees with alternate, simple, entire lvs. 3-nerved at the base and with white or pink fls. in dense terminal corymbs: calyx funnel-form-campanulate, 4-5-toothed; petals 5, clawed; stamens adnate to the long gynophore, much exceeding the petals, 15, forming a globose head; ovary 5-lobed; stigma sessile: caps. large, woody, septicidally 5-valved, seeds 2 in each cell, compressed, winged. Little known in cult. and adapted only for warmer temperate regions. Prop. probably by cuttings from half-ripened wood. **R. thyrsoidea**, Lindl. Evergreen shrub: lvs. ovate-oblong to oblong-lanceolate, glabrous, 2-5 in. long: fls.

creamy white, ½ in. across; gynophore ½-¾ in. long. China. B.R. 1236. B.M. 4199. F.S. 3:206. **R. pubescens**, Mast. Similar to the preceding: lvs. ovate to ovate-oblong, subcordate to broadly cuneate at the base, brownish tomentose beneath, 3-5 in. long: fls. somewhat larger, pink; gynophore 1 in. long. E. Himalaya, S. W. China. Recently intro.

ALFRED REHDER.

REHMANNIA (Jos. Rehmann, 1779-1831). *Scrophulariaceae*. Perennial viscous-villous herbs suitable for the cool greenhouse, grown for the showy bloom.

Stems leafy, branched from the base, either low, scapiform and almost leafless, or (especially in cult.) tall and few-lvd.: lvs. alternate, obovate or oblong, coarsely



3358. Traveler's tree.—*Ravenala madagascariensis*.

dentate: fls. rather large, borne in terminal racemes and short-pedicelled, brownish purple or pale, the throat intensely colored; calyx ovoid-campanulate, 5-cleft at the top; corolla pilose, slightly incurved, tube rather broadly subventricose, limb obliquely 2-lobed, the lobes spread, the rear or inner one deeply 2-cleft, the front one 3-cleft; stamens 4: caps. broad, partly included in the calyx; seeds numerous.—About 5 species, China and Japan.

angulata, Hemsl. Perennial plant, 1-3 ft. high, glandular-hairy: lvs. pinnately lobed, each side of lf. having either very many marginal teeth, or, if there are a few lobes or large teeth, by these being again toothed; the bracts broadly and abruptly cuneate at the base which is wider than any other part of the blade: corolla smaller than *R. elata*, red with a band of scarlet at the margin of the upper lip and has orange dots inside the lower lip. China. G.C. III. 33:296; 47:104. G. 25:171; 28:211. Gn. 63, p. 317. F.M. 46:290; 51:745. Gn. W. 21:117. Gt. 55:1547. G.W. 9, p. 114; 11, p. 488; 12, p. 362. J.H. III. 46:422; 71:11. R.H. 1905:586. F.S.R. 2:280. F.E. 20:526.—Many of these illustrations are probably of *R. elata*.

Var. **tigrina**, Hort., is said to be a garden hybrid of which *R. angulata* is one of the parents: fls. marked. An interesting form.

Var. *tricolor*, Hort. Fls. at first bright purple, later almost violet-rose, the upper lip shaded with vermillion and the throat whitish, spotted with purple. China.

Briscoi, Hort. (*R. elata* × *R. Henryi*). Intermediate in most characters, dwarfer than the former in having an erect infl. instead of a condensed one: the fls. are intermediate in color and of a soft pink: the lvs. arranged in a rosette are similar in shape to those of *R.*



3359. *Rehmannia elata*. (× ¼)

Henryi and have the same dark veinings, while they are much more velvety-hairy than those of *R. elata* but less so than those of *R. Henryi*. A garden hybrid. G.C. III. 47:188.

elata, N. E. Br. (*R. angulata*, Hort. not Hemsl.). Fig. 3359. Twice as large as *R. angulata*: lvs. 2-6-lobed on each side, lobes acute, entire; bracts or flowering lvs. long-cuneate at base: corolla slightly larger than *R. angulata*, bright rosy purple on the lips and yellow dotted red in the throat. China. B.M. 8177 (as *R. angulata*).

glutinosa, Libosch. (*R. chinensis*, Fisch. & Mey.). Plant pubescent-hirsute: st. 6-12 in. high, erect and weak: lvs. alternate, obovate, attenuate to a short petiole, remotely and coarsely serrate: fls. axillary and solitary, large, yellowish buff or purplish, purple at the throat and purple-veined; calyx-tube oval, inflated, 5-parted, segms. recurved, ovate; corolla hairy, limb 2-lipped. China. B.M. 3653. B.R. 1960. F.S. 11:1134. G. 28:210.

Henryi, N. E. Br. (*R. Piasézkii*, Hemsl., not Maxim.). Perennial herb, 6-18 in. high, glandular-hairy: lowest

lvs. 3-7 in. long, elliptic-oblong, obtuse, base narrowed to the petiole, crenately toothed, or more or less pinately lobed and obtusely dentate: fls. axillary; calyx ascending, never nodding, campanulate, lobes spreading, deltoid or deltoid-ovate, obtuse; corolla-tube 1¼-2 in. long, pubescent outside, dirty yellow spotted red, limb oblique, 2-lipped, white and pubescent, yellow, red-dotted at the throat, upper lip 2-lobed, lower 3-lobed, all the lobes rounded; ovary ovoid, glabrous. China. B.M. 8302. G.C. III. 47:189. G. 31:343. R.H. 1910, p. 571.

kewensis, Hort. (*R. Henryi* × *R. glutinosa*). Sts. leafy, about 2 ft. high: lvs. petioled, ovate, glossy green, irregularly dentate: fls. 2 in. long, 1½ in. across, the corolla-segms. broad, almost square in outline and toothed, creamy yellow with a dark crimson blotch on the upper segms. A garden hybrid. G.C. III. 51:218. Gn. 76, p. 296. G.M. 55:485. J.H. III. 66:469.

F. TRACY HUBBARD.

REIDIA: *Phyllanthus*.

REINECKIA (J. Reinecke, a German gardener). *Liliaceae*. A tender perennial herb, with attractive foliage in tufts 1-1½ ft. high from a thick, creeping rootstock: lvs. rather long, channeled: scapes leafless: fls. sessile, in a loose spike; perianth-tube cylindrical; lobes recurved, spreading; ovary 3-loculed, with a few seeds to each cell: berry globular, usually with 1 seed to each cell. A single species from China and Japan. The following is procurable from Dutch bulb-growers. *B. carnea*, Kunth. Fls. dull flesh or pink: bracts rather large, tinted red: fr. red, 3-4 lines diam. Var. *variegata*, Hort., is also offered. I.H. 9:323.

REIN ORCHIS: *Habenaria*.

REINWARDTIA (named in honor of Kaspar Georg Karl Reinwardt, 1773-1822, scientist of Leyden). *Lindaceae*. Subshrubs, sometimes nearly shrubs, suitable for the warmhouse.

Leaves alternate, entire or crenate-serrate; stipules minute, subulate, caducous: fls. yellow, in axillary and terminal cymose fascicles, rarely solitary; sepals 5, entire, lanceolate, acuminate; petals 5, contorted, fugacious, much longer than the sepals; stamens 5; ovary 3-5-celled: caps. globose, splitting into 6-8 cocci. —Two species, India. The genus is closely allied to the flax (*Linum*), and *Reinwardtia trigyna* is known to this day as *Linum trigynum* by the gardeners, who usually accent trigynum on the second syllable instead of the first. *Reinwardtia* is distinguished from *Linum* by the yellow fls., 3-4 styles and unequal or deficient glands; *Linum* has mostly blue, rosy or white fls., 5 styles, and equal glands.

Reinwardtias are showy subshrubs about a foot high with bright yellow flowers. They are useful for the decoration of the conservatory in winter time, at a season when yellow is scarce. To have presentable plants, it is necessary to give them a good deal of attention. It is difficult sometimes to get suitable cuttings; the strong growths which start away from the base when the plants are cut down make the best plants. Topshoots will grow, but seldom make good plants, as they are liable to go to bloom prematurely. Sandy loam is the best compost. Plants that have been grown in pots for



3360. *Reinwardtia trigyna*. (× 1/3)

a season may be planted out in early summer, and these will make good plants and furnish cuttings. They will have to be topped frequently and carefully lifted. Young stock is better kept in pots, as the plants do not lift well. Sunshine is essential during the winter season to get the best development of reinwardtias. They thrive best in a temperature of 55–60°. (T. D. Hatfield.)

A. Lvs. entire: styles 3.

trigyna, Planch. (*R. indica*, Dum. *Linum trigynum*, Roxbg.). Fig. 3360. Lvs. elliptic-obovate, entire or minutely toothed, tip rounded or subacute. B. M. 1100. Gn. 29, p. 279. G. 6:611; 10:344; 32:101. G.W. 2, p. 297. H.F. II. 6:136. J.H. III. 54:507.—Grows 2–3 ft. high in the wild.

AA. Lvs. toothed: styles 4 or 3.

teträgyna, Planch. Lvs. elliptic-lanceolate, acuminate, crenate-serrate. B. M. 7136. G.C. III. 16:721. R.H. 1867:292. Gn. 61, p. 198. WILHELM MILLER.

F. TRACY HUBBARD.†

REMUSATIA (named for G. P. A. Remusat, 1785–1832). *Araceæ*. Tuberous herbs, flowering and leafing in alternate years, and bearing long radical bulbiferous shoots; warmhouse foliage plants. Lf. solitary, entire, peltate: spathe coriaceous, tube convolute, ovoid, limb broad or narrow, deciduous; spadix very short, sessile, male and female infl. separated by neuters, appendage none; male infl. clavate, female short and cylindric; ovaries ovoid, 1-celled: berries small.—Three or 4 species, natives of the mountains of India and Java.

vivipara, Schott. Tuber the size of a hazel or walnut; bulbiferous shoots very stout, suberect or ascending, simple or very shortly branched: lf. 5 x 3½–18 x 12 in., membranous, orbicular, ovate or cordate, acute or acuminate; petiole 1 ft. or less long; spathe 4–5 in. long, tube green, limb broadly orbicular-obovate, cuspidate, 2–3 in. broad, golden yellow; spadix 1–1½ in. long. India and Java.

RENANTHERA (named from the reniform anther). *Orchidaceæ*. Tall climbing epiphytes.

Stems branched, sometimes 12–14 ft. high: lvs. distichous on the st.: fls. in large, drooping racemes or panicles; sepals and petals spreading, similar or the lateral sepals often larger and of a different color; labellum small, movably joined to the column, spurred or spurless, often with small, erect, lateral lobes.—About 15 or more species, in Malay Archipelago and Cochinchina. Cult. is similar to that of *Aërides* and *Vanda*.

coccinea, Lour. Fig. 3361. Sts. 8–10 ft. high, branched, climbing by means of white fleshy roots: lvs. in 2 rows, oblong, notched at the end, 4–5 in. long; fls. open, 2–3 in. across, in loose, branching racemes 2–3 ft. long, very brilliant; petals and dorsal sepal linear-spatulate, deep red, blotched with orange; lateral sepals larger, oblong, broader toward the apex, undulate, deep crimson, with palertransverse lines; labellum small. Autumn. Cochinchina. B. M. 2997, 2998. B. R. 1131. P. M. 4:49. F. S. 7, p. 163. G. C. 1845:491.—Does not flower readily in cult., but is very showy.

Störkei, Reichb. f. St. slender, climbing, 10–12 ft. high: lvs. alternate, oblong to linear-oblong: panicle about 1 ft. long and nearly as broad; fls. 2½–3 in. long; petals and dorsal sepal erect, linear-spatulate, orange-red, mottled with crimson; lateral sepals pendulous, obovate-spatulate, undulate, crimson with large blood-red blotches; labellum very small. Philippines. B. M. 7537. Gn. 53, p. 119. G. M. 39:659.

Löwei, Reichb. f. (*Vanda Löwei*, Lindl.). Fig. 3362. Sts. very long, climbing, somewhat branched: lvs. rather crowded, strap-shaped, 2–3 ft. long: racemes

from the upper axils, 6–12 ft. long, bearing 40–50 fls.; fls. of two kinds, the lowest pair tawny yellow with crimson spots, the others larger, pale yellowish green, irregularly blotched with reddish brown; sepals and petals lanceolate, acute, undulate, on the lowest pair shorter, blunter, and more fleshy. Borneo. B. M. 5475. I. H. 11:417. R. H. 1868:110; 1884, p. 343. F. S. 21:2256. Gt. 37, pp. 108, 109. Gn. 11, p. 524; 16, pp. 354, 355; 32, p. 197. G. C. II. 20:657; III. 27:3.—A very remarkable orchid.

R. annamensis, Rolfe. Dwarf, erect, up to 1 ft. tall: lvs. unequally 2-lobed at apex, 2–3 in. long, about ½ in. broad: racemes



3361. *Renanthera coccinea*. (× ½)

many-fl.; fls. yellow, crimson-spotted on the sepals, spur and base of petals, the last also with an apical deep crimson spot; dorsal sepal oblong, obtuse, ½ in. long, the lateral spatulate, ½ in. long; petals obtuse, ½ in. long; lip 3-lobed, ¼ in. long, the lobes crimson. Annam. B. M. 8116.—*R. Imchootiana*, Rolfe. Sts. 1 ft. long: lvs. linear-oblong, 2–4 in. long, 1 in. wide: infl. a raceme or panicle, up to 1 ft. long, the rachis, branches and pedicels bright red; dorsal sepal linear-oblong, obtuse, dull yellow, ¼ in. long, lateral 1½ in. long, clawed, oval, cinnabar-red above, ochre beneath; petals a little shorter than dorsal sepal, narrowly spatulate, yellow, spotted blood-red; lip minute, 3-lobed. Assam. B. M. 7711. Gn. W. 11:809. O. 1910, p. 24.—*R. matutina*, Lindl. St. 2–3 ft.: lvs. linear-oblong, 4–6 in. long: fls. numerous, reddish crimson, toned yellow, and becoming orange-yellow when old; sepals and petals similar, linear, acute; lip saccate, subcylindric. Java. R. B. 31:252.—*R. pulchella*, Rolfe. Resembling *R. Imchootiana*, but fls. only about half the size, yellow, with side lobes of lip and upper half of petals crimson. Burma.

HEINRICH HASSELBRING.

GEORGE V. NASH.†

RENEALMIA (in honor of Paul Renealme, a French botanist). *Zingiberaceæ*. Perennial aromatic herbs, suitable for cult. in the warmhouse or outdoors in the extreme S.: rootstock fleshy: sts. leafy: lvs. more or less long-petioled or sessile, lanceolate or oblong: infl.

terminal or scapose and either paniculate or racemose; fls. white, yellow or red; calyx short, 3-lobed; corolla short-tubed, the lobes erect or finally spreading, subequal or the posterior broader and concave; ovary 3-celled: caps. globose. About 60 species, Trop. Amer. and a few in Trop. Afr. *R. exaltata*, Linn. f., is recently intro. as a dye-plant; also ornamental, with reddish peduncles and bracts, and yellow fls.: lvs. like a canna: the fleshy hulls of fr. yield dye and ink. W. Indies.



3362. *Renanthera Lowei*.
($\times \frac{1}{2}$)

RESÉDA (from the Latin *to calm*; said to allude to supposed sedative properties). *Resedaceae*. One species is grown as a garden annual, and also under glass, for its pleasing fragrance: Mignonette, which see (Vol. IV, p. 2049).

Herbs (sometimes partially woody at the base) with alternate, simple or compound lvs., and terminal spikes of inconspicuous perfect fls., which have 4-7 small greenish toothed or cleft unequal petals and 8-40 small stamens attached on one side of the fl.: pistil 1, ripening into a 3-6-horned or -angled cap. that opens at the top at maturity (Fig. 3363), and contains several to many seeds. Only one species, the common mignonette (*R. odorata*), is generally known, but two or three other species are sometimes grown. Two other species are occasional weeds in the East.—*R. Luteola*, Linn., the dyer's weed (formerly used as yellow dye), 1-2 ft. tall, with entire lvs., 4 or 5 greenish petals of which the lowest one is entire; and *R. lutea*, Linn., with pinnatifid lvs. and petals usually 6; and two or three of the perennial species are more or less recommended as border plants. This genus contains 50-60 species, most of which are native to the Medit. basin, Arabia and Persia.

A. Lvs. entire or only notched.

odorata, Linn. COMMON MIGNONETTE. Fig. 3363; also 2372, p. 2049. Branching annual herb, at first upright but becoming wide-spreading and more or less decumbent: lvs. spatulate or oblanceolate, mostly obtuse, usually entire but sometimes notched: fls. yellowish white, in spicate racemes that become loose and open with age, very fragrant. N. Afr. B.M. 29. Gn. 55, p. 409.—Much grown for its strong and agreeable fragrance. It has been greatly modified under domestication. The following garden names seem to belong to this species: *arborea*, *ameliorata*, *compacta*, *eximia*, *gigantea*, *grandiflora*, *pyramidalis*, *multiflora*,

pumila; they represent stature-forms and habit-forms of the horticulturists. Var. *suffruticosa*, Edw., is woody at the base. B.R. 227. Many named varieties of *R. odorata* are in the trade. See *Mignonette*.

glauca, Linn. Glabrous and somewhat glaucous perennial, less than 1 ft. tall, with many spreading sts.: lvs. narrow-linear, entire, or 2-toothed near the base: petals 5 or 6, the upper ones 3-lobed; stamens about 14. Pyrenees.—Recommended for dry places, as a border plant. See p. 1467.

AA. Lvs. usually prominently lobed or pinnatifid.

alba, Linn. WHITE UPRIGHT MIGNONETTE. Straight-growing erect glabrous annual or biennial, 1-3 ft., weedy: lvs. numerous, long-stalked, deeply and irregularly pinnatifid, the segms. usually linear and sometimes toothed: fls. greenish white, in a very long slender spike; stamens about a dozen, and petals 5-6. S. Eu. G.C. III. 20:45. G.W. 8, p. 255.—A commendable plant for growing as an ornamental subject in the fl.-border with other plants. It bears many spikes on tall branches, making it a conspicuous plant; treated as a half-hardy annual; odor not pleasing. It occurs somewhat in this country as an adventive plant.

crystallina, Webb. Glabrous, sparingly branched, somewhat glaucous annual: lvs. usually 3-parted, or the lowest ones entire: fls. deep yellow, in racemes. Canary Is. —Has been offered as a garden annual.

L. H. B.

RÉSTIO (Latin, *rope*, alluding to the use made of the plants in S. Afr.). *Restiaceae*. Perennial herbs with a tufted or creeping rootstock, of little horticultural significance: sts. terete, compressed or 4-sided, with remote sheathing lf.-sheaths, usually more or less mucronate, sometimes prolonged into a linear blunt lf.: male and female infl. similar or dissimilar, spicate, spikes solitary or spikelets numerous in spicate or panicle cymes; fls. dioecious, 1-bracteate; perianth usually of 6, sometimes 4 segms. in 2 rows, rarely none; ovary 2- or 3-celled: caps. 2- or 3-celled, or by abortion 1-celled, 1 seed in each cell. About 170 species, half of them from S. W. Afr. the remainder from S. W. Austral. *R. subverticillatus*, Mast. Sts. erect, 3-4 ft. high, with verticillate branches: sheaths about 1 in. long, coriaceous, striate above, membranous, spreading, acuminate, smaller sheaths foliaceous from beneath a 2-lobed hyaline apex: perianth-segms., male, broadly oblong, the lateral villous-keeled, female broader: caps. obliquely ovate, 1-celled, 1-seeded. S. Afr. G.M. 43:76.

REST-PERIOD IN PLANTS. The rest-period of plants is that period or stage when the part or parts at inaction are incapable of responding to favorable growing conditions. A rest-period of some length, either short or long, appears to be universal with all perennial plant forms. So far as known, none has a continuous growth. Trees and shrubs growing in the open, both in cold and warm climates of the temperate zone, may begin to enter the rest-period in some of their branches as early as midsummer. This is indicated by cessation of length growth and formation of terminal buds. Some may be ready to grow again in a few weeks, while others are unable to grow for five or six months. Herbaceous perennials begin their rest after dying down in summer or fall. The death of the aerial parts is accompanied by the formation of strong crown-buds. They are usually ready to resume growth within a few days or weeks, although there are notable



3363. Pod of *Reseda odorata*. ($\times 2$)

exceptions. Bulbs begin their rest when the tops die down after flowering. Many will not grow again for several months. Many seeds germinate poorly, or not at all, if planted immediately or shortly after ripening. Failure to grow is usually due to the influence of a rest-period. However, aside from the effects of a rest-period, seeds may fail to germinate promptly or at all on account of a hard or tough seed-coat which is more or less impervious to water. In garden practice, seeds are stored for a few weeks or months before planting in order that they may pass through a period of "after-ripening." Those with hard or tough seed-coats are stored by stratifying in moist sand.

Investigation has shown that practically all woody plants native to the temperate zone have a rest-period. Many of these are unable to grow in late fall or early winter, even when transferred to a warm moist greenhouse. In trees and shrubs the rest-period begins to set in as early as midsummer. The length of the rest varies greatly. In some cases it may last only a few days or weeks, while in others it may persist from three to six months. Red raspberries, mountain-ash, and spiraeas are almost free from a rest-period, while white oak, tulip tree, and American beech commonly rest for six or seven months. Among herbaceous perennials, the lily-of-the-valley is conspicuous for its rather long rest-period which usually lasts for two or three months. Asparagus, rhubarb, hardy chrysanthemum, golden marguerite, calliopsis, and a host of others are ready to grow again in a week or two after the old plants die down. All spring-flowering bulbs appear to have a distinct rest-period lasting from three to five months. From 50 to 75 per cent of the seeds of herbaceous plants, annual and perennial, have a rest-period, while the resting phase is noticeable and generally very distinct in fully 90 per cent of the seeds of trees and shrubs.

The rest-period is commonly looked upon as the period of dormancy in plants and seeds, but this view is incorrect. The rest-period of trees, for example, begins and ends entirely independent of the winter season. While cold weather may prevent growth from taking place, it does not necessarily prevent the rest-period from coming to an end and thus leaving the trees ready to grow as soon as surrounding conditions are favorable. In mild climates the rest begins and ends with great regularity. The same is true in cold climates, but in the case of trees, at least, the true condition of affairs is not apparent on account of the interference of the cold which prevents growth. In trees the rest sets in gradually twig by twig and is not complete until all the growing points have ceased elongating and formed terminal buds. In like manner the trees pass out of their resting state gradually, some twigs often being ready to grow much earlier than others. These phenomena are very noticeable when trees are grown under glass.

The rest-period of many trees and shrubs may be broken or greatly shortened by special treatments. Those with a long rest-period are very difficult to arouse during the early stages of their rest. The greater part can be forced with comparative ease during the middle period of their rest and to some extent during the latter phases, although at this time the treatments must be less severe or the plants may be killed. The agents most generally used for forcing growth are ether, drying, and freezing. Submerging in warm water will sometimes start growth, particularly in dormant twigs. Twigs of flowering shrubs, such as lilac, deutzia, spirea, and golden-bell, may be caused to burst into bloom in early or midwinter by placing them in a tight vessel and pouring in ether at the rate of one teaspoonful to each two gallons of space. Allow the plants to remain in the ether vapor for twenty-four hours, when they should be taken out and stood in vessels of water in a warm moist room. It is very necessary to have the air

moist to keep the buds from drying out before they begin to grow. Potted plants of all kinds, both woody and herbaceous, may be similarly treated, provided the surface of the soil in the pots is dry, as moist or wet soil will absorb too much of the ether. Many herbaceous plants do not respond to the ether treatment and some are killed. The best treatment for forcing hardy herbaceous perennials is to lift them in the fall, subject them to a temperature a few degrees below freezing for twelve to twenty-four hours, and then place them in a mild hotbed. By mid- or late winter most plants may be forced with heat alone. There are perhaps thirty or forty different agents that have been successfully used for forcing plants.

Of just what value the rest-period is to the different plants and plant parts is not known. It is highly probable, however, that the period of inactivity is utilized for the conservation of energy through the special work the enzymes are able to perform while the growing parts are dormant, that they could not do in the presence of active growth.

The cause of the rest-period and the specific effects of the rest-period-breaking agents on the plant organism have been carefully studied only in connection with woody plants. It has been thought that the rest-period in trees sets in on account of the inhibition of enzyme activity due to an over-accumulation of the products of their work. The early phases of the rest-period occur and are passed through while the plants are in full leaf and often while some of the parts are still making active growth. The parts to enter the resting state first, in fruit-trees particularly, are the so-called spurs which are short lateral outgrowths usually arising from wood that grew the previous year. These cease growing early in the season, probably because of imperfect sap circulation. The crude sap from the roots rises most rapidly in those branches and twigs that are nearest in a straight line upward from the ground. It would appear then that the spurs, on account of their position, are deprived of water very early in the growing season. Assimilation goes forward rapidly in those parts that first approach a state of maturity. With a decreased water-supply and a greatly increased deposition or accumulation of carbohydrates, enzyme activity is soon checked if not entirely inhibited. As the season advances, the approach of cool weather may hasten the period of dormancy, but the trees would go dormant just the same, although later, in a mild climate or under glass. It is thus seen that the rest-period of trees is gradual, beginning in the spurs and gradually involving all of the branches.

Briefly, the rest-period perhaps begins to set in on account of the inhibition of the enzymes by the over-accumulation of the products of their work. This is the early rest of mid- or late summer. In the fall, excess supplies of carbohydrates continue to be accumulated and, with trees growing in the open, the further inhibition of the enzymes is actively aided by the approach of cool weather. These factors acting together bring about the main or middle state of rest. However, since dormant trees are never completely at rest, respiration continuing all the time, and doubtless enzyme activity too, the over-accumulation of carbohydrates is gradually reduced. Toward the last of this period occurs the after-rest, which, as the enzymes become more and more active, gives place to the beginning of growth.

Research has shown that diastatic, proteolytic, fat-splitting, and oxidizing enzymes all play a prominent part in bringing about, as well as ending, the rest-period in woody plants. Any forces or agents that will reduce the activity of these ferments will be the means of causing the rest-period to set in and, similarly, any agent that will stimulate the enzymes into activity will be the means of bringing the rest-period to an end. (See Research Bulletins Nos. 1, 15, 16, 17, 21, Missouri Agricultural Experiment Station.) W. L. HOWARD.

RESTREPIA (Joseph Emanuel Restrep, a student of natural history in the tropics). *Orchidaceae*. Very interesting little plants, allied to *Masdevallia* and not unlike that genus in habit and appearance.

Stems tufted on creeping rhizomes, each bearing a single lf. and clothed below with scales; fl.-sts. appear from the axil of the lvs.: perennial, producing fls. for several years in succession: dorsal sepal free, ending in a filiform, clavate tail; lateral sepals united into a broad blade, bifid only at the apex; petals like the dorsal sepal, but smaller; labellum oblong or ovate, often with 2 small teeth near the base.—About 40 species, from Brazil to Mex., few of which are cult. for their curious fls. They are easily grown at a temperature suited for cool odontoglossums (40–55°). They thrive well planted in a mixture of peat and sphagnum in baskets, which are usually suspended near the glass. They have no definite resting period, but do not require so large a quantity of water in winter as during their most active growth. Pot moderately firm, and rest in a coolhouse.

antennifera, HBK. Sts. slender, clustered, 4–6 in. high, clothed with imbricated scales, and bearing one (rarely more) ovate-cordate petioled lf.: peduncle from the axil of the lf., slender, 1-fld.: dorsal sepal 1½ in. long, lanceolate, tapering into a slender clavate tail, yellow, with purple lines and a purple tip; lateral sepals united into an oblong blade 2-lobed at the tip, yellow, marked with red-purple dots; petals small, antenna-like, purple at the tip. Nov.–Feb. Colombia, Venezuela. B.M. 6288; 7930. I.H. 16:601. A.F. 6:631.

Dayana, Reichb. f. A small plant growing in dense tufts: lvs. roundish, acute, cordate: dorsal sepal and petals filiform, clavate, shining, violet-brown; lower sepals united into a broad, bifid blade, yellow and brown. Costa Rica.

élegans, Karst. Tufted, epiphytic, 2–3 in. high: lvs. 1–1½ in. long, elliptic: peduncles usually in pairs: fls. 1½–2 in. long; dorsal sepal erect, lanceolate, white, streaked purple, with a tail as long as itself, which is clubbed at the tip and yellow; lateral sepals connate into an oblong, emarginate, concave blade, yellow, spotted purple; petals like the dorsal sepal, but spreading and only half the size; lip half the size of the connate lateral sepals and of the same color but edged with red. Venezuela. B.M. 5966. F.S. 7:743.

R. aspicinereum, Reichb. f. Only 2–3 in. high: fls. small, deep yellow, densely spotted with crimson or chocolate-brown. Venezuela.

HEINRICH HASSELBRING.

RESURRECTION PLANTS are such plants as “come to life” after being apparently dead. They are kept in a dried state as curiosities, to be “resurrected” on occasion, and sometimes they are grown for a similar purpose but they are scarcely horticultural subjects.



3364. Rose of Jericho in the dry state.

The commonest resurrection plants are members of the mustard family and the club moss family. Others are *Asteriscus*, a composite, and *Mesembryanthemum*, of the fig-marigold family. Many plants can be similarly revived from the dried state, particularly those of desert regions.

1. The rose of Jericho is properly *Anastatica hierochuntica*, Linn., which name means “resurrection plant from Jericho.” The plant is a native of the sandy deserts from Arabia and Syria to Algeria. It is an annual and grows about 6 inches high. Soon after flowering the leaves fall and the branches become woody and roll up into a ball, reminding one of wickerwork or lattice. (Fig. 3364.) Inside the ball are the seeds, or, in botanical language, the fruits, which are borne in a protected position near

RESURRECTION PLANTS

the tips or on the sides of the inrolled branches. (Fig. 3365.) The plants are up-rooted by the winds and are blown about on the deserts. These balls were thought by many to be “the rolling thing before the whirlwind” mentioned in Isaiah, and were brought to Europe by the crusaders. The shape of these balls



3365. Rose of Jericho as it opens after being moistened.

might be fancifully compared to that of an unopened rose. When the winter rains descend or when the balls are blown into the Mediterranean the branches at once open back and stretch out straight, the fruits open, and

the seeds germinate very quickly, “often in the fruit,” according to Warming. The dead plants do not, of course, “come to life,” but they retain their hygroscopic properties for many years.

Botanically, *Anastatica* is distinct by reason of its short and broad fruit or silicle, which has two ear-like appendages at the top. The silicle is divided by a transverse partition into two cells, each of which contains a seed. There is only one species. The genus belongs to the *Arabis* tribe of the *Cruciferae*, but is exceptional in not having a long slender silicle. The growing plant has obovate leaves, the lower ones entire, upper ones toothed, and the flowers are small, white, and borne in spikes in midsummer. Excellent pictures of resurrection plants may be found in Kerner & Oliver’s “Natural History of Plants,” together with accounts of the behavior of the various kinds. See also B.M. 4400, G.C. 1872:1068, Gn. 4, p. 111. These plants have much folk-lore.

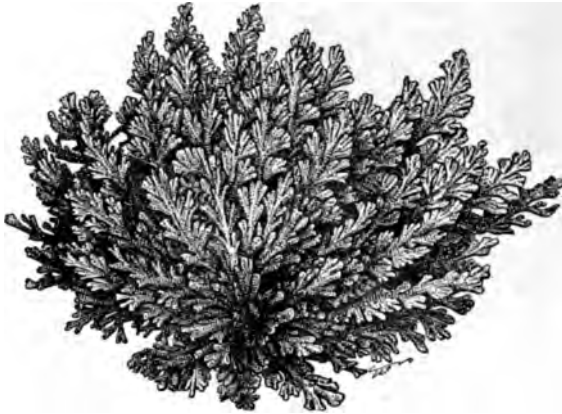
2. The bird’s-nest moss, *Selaginella lepidophylla*, is a native of Mexico and reaches into western Texas. Many selaginellas curl up if allowed to dry, and several of the Mexican species do so in their native places in the dry season, but this species is said to make a tighter mass than any other. When placed in lukewarm water the fronds loosen and roll back into a flat or saucer-like position. The plant may become green and grow, and it is also said that it may be dried and revived an indefinite number of times. The specimen shown in Figs. 3366, 3367 was “resurrected” four times after it came into the hands of the Editor, and showed no indications of a limit to its reviving possibilities. Selaginellas are beautiful moss-like plants. What appear to be the leaves are really the branches, and the true leaves are scale-like. See Gn. 17, p. 400; F. 1871, p. 144; also *Selaginella*.

3. A member of the composite family (*Odontospermum pygmaeum*, or *Asteriscus pygmaeus*) is also called rose of Jericho, has the same range as No. 1, and was also brought to Europe by the crusaders. (Fig. 3368.) The branches do not roll up, but the involucre closes over the head of fruit in the dry season, and is loosened by moisture when the seeds escape.



3366. *Selaginella lepidophylla*, one of the resurrection plants. (× ½)

4. Several species of *Mesembryanthemum* are known to be hygroscopic. According to Kerner & Oliver, "the capsular fruits of these plants remain closed in dry weather; but the moment they are moistened the valves covering the ventral sutures of the fruit-loculi open back, dehiscence takes place along the ventral



3367. The plant shown in Fig. 3366 when "resurrected."

sutures, and the seeds, hitherto retained in a double shroud, are washed out of the loculi by the rain." It is doubtful whether these capsules are offered in the trade. WILHELM MILLER.

The cultivation of resurrection plants.

Anastatica is sometimes grown for curiosity or for botanical purposes, but the plant is anything but ornamental. It has often been grown for classes in botany, sowing the seed in February in pots and keeping the plants in pots all summer. Bottom heat is not necessary at any stage, at least in America. The plant could be grown in a window-garden. The seeds may be sown in February in 4-inch pots, using a light, sandy soil, in a house with a temperature of 60° F. As soon as the seedlings are large enough they are transplanted into other 4-inch pots, three plants to a pot.

The *Selaginella lepidophylla* is perennial. It is rarely cultivated in greenhouses for ornament, like the evergreen kinds of *Selaginella*. It is grown chiefly in botanic gardens or by fanciers of ferns and *Selaginellas*, as it is by no means the most beautiful member of the genus. The writer grew a plant of it for four years, and once saw at one of the botanical gardens a plant which through long cultivation had developed a stem almost a foot high. It looked like a miniature tree-fern, except of course that the fronds were arranged in a dense rosette, which gave the fronds a flat rather than a pendulous appearance. Whether the plants received directly from Texas have a crop of spores on them is a question. The spores do not discharge when the plants are wetted. Many extravagant statements are made about the bird's-nest moss. The dried plants offered by the trade will turn green and grow unless they are too old or have been kept dry too long. They would probably not grow if kept over more than one season. They cannot be dried again and again indefinitely and still remain alive.



3368. Another "rose of Jericho," *Odontospermum*, or *Asteriscus*. The bracts roll out and make a flat star-shaped figure.

If a plant has been grown in a pot three or four years and is then dried off it will die. Most persons who grow these plants as curiosities place them in a bowl of water with perhaps a little sand and a few pebbles. The water causes them to turn green and they will grow for a time. Then if taken out of the water they may be kept dry for a time and the process repeated, but each time the plant loses its lower or outer circles of fronds much faster than new ones are made and at about the third time the plant is commonly used up.

There is a fern (*Polypodium polypodioides*, page 2744) which could just as truly be called a resurrection plant. It is a native of the southern states, where it grows up the trunks of trees and over rocks and stones. At certain times it is dried up and parched, but as soon as moisture conditions are restored it looks as fresh as ever. In warm dry countries there are ferns of various genera that dry up and then are resurrected quickly when wet weather comes; some of these are very interesting.

EDWARD J. CANNING.

RETARDING is the opposite of forcing, and consists in keeping plants in cold storage, thereby preventing them from growing during their natural season. Its object is to supplement natural methods and forcing in order to produce the same thing the year round. The lily-of-the-valley is one of the plants of the first importance which may be retarded in commercial establishments. There is sufficient demand for these flowers all the year round to justify the expense of cold storage. Lily-of-the-valley "pips" may be taken from cold storage and forced into bloom in three weeks. Plants that have been retarded need very little heat when they are allowed to grow; they are eager to start, and a temperature of 45° to 50° is sufficient. *Lilium speciosum*, *L. longiflorum*, and *L. auratum* will bloom in ten to twelve weeks from cold storage; *Azalea mollis* in three to four weeks; spireas in about five weeks. Sea-kale and lilacs have also been retarded with profit. Goldenrod has been kept in an icehouse all summer and flowered for Christmas with good results. The art of retarding plants is making progress at present, and with the growth of popular taste for flowers the list of retarded plants may be greatly extended in the future. See A. F. 16:654, 655 (1900).

RETINISPORA. Often but not originally spelled *Retinospora*. A genus of conifers founded originally by Siebold and Zuccarini on the two Japanese species of *Chamaecyparis*, chiefly distinguished from the American species by the resinous canals of the seeds (from Greek, *retine*, resin, and *spora*, seed). Afterward the genus was united with *Chamaecyparis*, but in horticultural nomenclature the name is applied to a number of juvenile forms of *Thuja* and *Chamaecyparis*, chiefly those introduced from Japan. As these juvenile forms all resemble each other very much, indeed much more than do the typical forms to which they belong, it is not strange that they should have been considered to be distinct species and even to belong to a separate genus. Even botanists failed to recognize the true relation of these forms and went so far as to place one of them in the genus *Juniperus*. With the exception of *Retinispora cricoides*, which C. Koch recognized as the juvenile form of *Thuja occidentalis*, the origin of these juvenile forms remained doubtful until L. Beissner, after having carefully studied the subject for years, disclosed the relationship of the various forms. He showed by experiment that it is possible to raise the same form by making cuttings from seedlings which have still retained their primordial foliage, and he also published cases in which larger plants of these doubtful forms have been observed accidentally to develop branches with the foliage of the typical form. See, also, Gt. 1879, pp. 109 and 172; 1881, pp. 210 and 299, and 1882, p. 152.

There are four of these juvenile forms generally in

cultivation, each of them with an intermediate form showing either a kind of foliage approaching that of the type or two different kinds of foliage on the same plant. There seems to be no doubt that all these forms have been secured by propagating branches of young seedling plants. All seedlings of *Chamaecyparis*, *Thuja*, and other genera of the Cupressineae produce in their juvenile state a kind of primordial foliage very different in appearance from that of the adult plants. The first leaves are always linear and spreading, passing gradually into acicular and at last scale-like leaves. In some plants, especially if they have not sufficient nourishment, the primordial foliage is retained longer than usual and these have probably been selected for perpetuating the juvenile state, by means of cuttings. By continuing through many generations the propagation of those branches which show the juvenile state most distinctly, these forms have become well-fixed varieties and even sometimes bear seeds without changing the foliage on the fruiting branches. These seeds, however, produce plants of the typical form and only a few of them retain the primordial foliage somewhat longer than usual.

The juvenile forms very much resemble some species of *Juniperus* in habit and foliage. They bear linear spreading leaves in pairs, changing in winter to a



3369. *Retinisporas*. The specimen on the left is *Thuja orientalis* var. *decussata*; middle, *Chamaecyparis thyoides* var. *ericoides*; right, *C. thyoides* var. *andelyensis*. ($\times \frac{3}{4}$)

brown, reddish, violet or steel color, and do not show the regular frond-like branching of the typical forms. The leaves, however, are much softer and not sharply and acutely pointed as in *Juniperus*; they are mostly marked with whitish or grayish green lines beneath, which is never the case in *Juniperus*. Only *Thuja orientalis* var. *decussata* and some intermediate forms, with acicular suberect leaves, show whitish marks on the upper side of the leaves like *Juniperus*.

Though these *Retinispora* forms are described under the genera and species to which they belong, where also references to illustrations are cited, descriptions are given here to afford a closer comparison of these similar and much confounded forms. The two forms of foliage in the common red cedar are well shown in Fig. 2025, Vol. III. For other pictures of *Retinispora* forms see *Chamaecyparis* and *Thuja*.

Chamaecyparis obtusa var. *ericoides*, Boehmer (*Retinispora Sanderi*, Sander. *Juniperus Sanderi*, Hort.). Dense round-headed bush with upright branches and bluish gray foliage: lvs. acicular, decussate, spreading, about $\frac{1}{4}$ in. long, thickish, concave above and with a green line in the middle, the lower lvs. often acutish, the upper ones obtuse.

Chamaecyparis pisifera var. *squarrosa*, Beissn. & Hochst. (*Retinispora squarrosa*, Sieb. & Zucc.). Fig. 893. A dense, pyramidal or round-headed bush or some-

times small tree, with light bluish green foliage almost silvery white when young, usually coloring violet in winter: tips of branchlets nodding: lvs. crowded, spreading, very soft, bluish green above, silvery white below. The most ornamental and graceful and the best known of these juvenile forms. The intermediate form, var. *plumosa*, Beissn. & Hochst. (*Retinispora plumosa*), has smaller, subulate and suberect lvs., and is much planted, especially in its golden variegated form. See Fig. 892, Vol. II.

Chamaecyparis thyoides var. *ericoides*, Sudw. (*Retinispora ericoides*, Zucc.). Fig. 3369. Dense shrub, of stiff, pyramidal or almost columnar habit, with upright branches and bright green foliage, changing to violet-red or brownish red in winter: lvs. bright green above, with 2 bluish lines below. This form is very distinct with its stiff, columnar habit, but is less common in cult. The intermediate form, var. *andelyensis*, Schneid. (*Retinispora leptoclada*, Hort.), shows also a stiff, pyramidal habit and bears chiefly small, suberect or almost scale-like lvs., and occasionally branchlets with spreading linear lvs. Fig. 3369.

Thuja occidentalis var. *ericoides*, Beissn. & Hochst. (*Retinispora ericoides*, Hort. *R. dubia*, Carr.). Dense broadly pyramidal or round-headed bush, with upright branches and dull green foliage, changing to brownish green in winter: lvs. linear, soft grayish green beneath. The intermediate form, var. *Ellwangeriana*, Beissn. (*Retinispora Ellwangeriana*, Hort.), has usually two kinds of lvs., but the linear lvs. are smaller than those of the preceding form.

Thuja orientalis var. *decussata*, Beissn. & Hochst. (*Retinispora juniperoides*, Carr. *R. decussata*, Hort. *R. squarrosa*, Hort.). Fig. 3369. Dense, round-headed bush, with bluish green foliage changing to violet or steel-color in winter: lvs. rather rigid, bluish green, spreading, concave and with a whitish line above. But rarely cult. and not quite hardy N. The intermediate form, var. *meldensis*, Laws. (*Retinispora meldensis*, Hort.), has mostly acicular suberect lvs. of the same color as in the preceding var. *andelyensis*.

These juvenile forms are valuable for formal gardening, for rockeries, small gardens and wherever slow-growing and dwarf conifers are desired. They are short-lived and usually becomes unsightly when older. They are all readily prop. by cuttings. See also *Chamaecyparis* and *Thuja*.

R. decussata, Hort. = *Thuja orientalis* var. *decussata*. — *R. dubia*, Carr. = *Thuja occidentalis* var. *ericoides*. — *R. Ellwangeriana*, Hort. = *Thuja occidentalis* var. *Ellwangeriana*. — *R. ericoides*, Zucc. = *Chamaecyparis thyoides* var. *ericoides*. — *R. ericoides*, Hort. = *Thuja occidentalis* var. *ericoides*. — *R. filicoides*, Hort. = *Chamaecyparis obtusa* var. *filicoides*. — *R. filifera*, Stand. = *Chamaecyparis pisifera* var. *filifera*. — *R. juniperoides*, Carr. = *Thuja orientalis* var. *decussata*. — *R. leptoclada*, Zucc. = *Chamaecyparis pisifera* var. *squarrosa*. — *R. leptoclada*, Hort. = *Chamaecyparis thyoides* var. *andelyensis*. — *R. lycopodioides*, Gord. = *Chamaecyparis obtusa* var. *lycopodioides*. — *R. meldensis*, Hort. = *Thuja orientalis* var. *meldensis*. — *R. obtusa*, Sieb. & Zucc. = *Chamaecyparis obtusa*. — *R. pistifera*, Sieb. & Zucc. = *Chamaecyparis pisifera*. — *R. rigida*, Carr. = *Thuja orientalis* var. *decussata*. — *R. Sieboldii*, Hort. = *Thuja orientalis* var. *decussata*. — *R. squarrosa*, Sieb. & Zucc. = *Chamaecyparis pisifera* var. *squarrosa*. — *R. squarrosa*, Hort. = *Thuja orientalis* var. *decussata*.

ALFRED REHDER.

REYNOSIA (named for Dr. Alvaro Reynoso, 1830–1888, a Cuban agricultural chemist). *Rhamnaceae*. Unarmed evergreen shrubs or trees, with rigid branches, sparingly cultivated, possibly for its edible fruit.

Leaves opposite, leathery, entire and emarginate; stipules small and caducous: fls. small, perfect, yellowish green, in sessile, axillary, umbel-like clusters; sepals 5, valvate spreading; petals wanting; stamens 5, inserted on the margin of the fleshy disk; ovary almost superior, 2–3-celled: drupe with a thin fleshy pulp and a crustaceous stone. — About 10 species, 1 in S. Fla.

latifolia, Griseb. RED IRONWOOD. DARLING PLUM. Slender tree, 20–25 ft. high: lvs. oval, oblong, or subround, usually emarginate, 1–1½ in. long, leathery; mar-

gins revolute: fls. in axillary umbels, borne in May: fr. ripens in Nov. or the following spring. S.S. 2:56.

F. TRACY HUBBARD.†

RHABDOTHÁMNUS (Greek, *rod* and *bush*, a shrub with many rod-like branches). *Gesneriaceæ*. Divaricately branched shrub, with slender branches: lvs. small, opposite, petioled, rotundate, coarsely dentate, often dissimilar: pedicels solitary in the axils, filiform and without bracts: fls. red-striped; calyx free, deeply 5-cleft, the lobes membranaceous, acuminate; corolla tubular-campanulate; the limb slightly oblique, somewhat 2-lipped, the lobes 5, rotundate, spreading and subequal; stamens 4, perfect: caps. ovate, acuminate, coriaceous, finally 4-valved.—One species, New Zeal. *R. Solandri*, A. Cunn. A much-branched, hispid shrub 1–3 ft. high: branches very slender, spreading at right angles: lvs. opposite, often in unequal pairs, oval or orbicular, coarsely toothed: fls. axillary, solitary, about 1 in. long; calyx hispid, 5-lobed, lobes lanceolate, acute; corolla glabrous, orange, striped red, limb 2-lipped, upper lip smaller, lower lip deeply 3-lobed, the lobes rounded: caps. ovoid acute. New Zeal. B.M. 8019. G.C. III. 37:146.

RHAMNÉLLA (referring to its close affinity to *Rhamnus*). *Rhamnaceæ*. About 6 species in E. Asia. Deciduous shrubs or small trees: lvs. alternate, stipulate, serrulate: fls. small, green, in axillary clusters; sepals, petals, and stamens 5; ovary incompletely 2-celled: fr. a black drupe with a 1-seeded stone. In habit resembling *Rhamnus*, but in fls. and frs. more like *Berberis*. Only the following species is in cult.; it seems somewhat tender and has no particular ornamental qualities; cult. and prop. like *rhamnus*. *R. franguloides*, Weberbauer (*R. japonica*, Miq. *Micro-rhamnus franguloides*, Maxim.). Small tree, to 30 ft.: lvs. ovate-oblong, acuminate, finely serrulate, with 5–10 pairs of veins, glabrous except on the veins beneath, 2–5 in. long: fls. in 5–15-fld. clusters: fr. cylindric-oblong, black, $\frac{1}{2}$ in. long. Japan, Korea, E. China. S.I.F. 2:48.

ALFRED REHDER.

RHÁMNUS (its ancient Greek name). Including *Frangula*. *Rhamnaceæ*. BUCKTHORN. Ornamental woody plants grown chiefly for their handsome foliage and some also for their attractive fruit.

Deciduous or evergreen shrubs or small trees, sometimes spiny: lvs. alternate or opposite, short-petioled, with small deciduous stipules, pinninerved, serrulate or entire: fls. small, in axillary clusters, umbels or racemes, perfect, polygamous or dioecious; sepals, petals and stamens 4–5, petals sometimes wanting; style usually undivided; ovary 2–4-loculed: fr. a globular or oblong 2–4-seeded drupe; nutlets with a leathery usually dehiscent wall.—About 100 species native chiefly to the temperate regions of the northern hemisphere. A few species are found in the tropics and as far south as Brazil and S. Afr. Several species yield yellow or green dyes and the frs. and bark of some are used medicinally. The wood of *R. Frangula* is made into charcoal valued for the manufacture of gunpowder.

The buckthorns are handsome shrubs with generally bright green often rather large leaves and with inconspicuous greenish flowers usually in axillary clusters followed by berry-like, usually black, rarely red, fruits. Many of the species as *R. cathartica*, *R. dahurica*, *R. fallax*, *R. Frangula*, and *R. alnifolia* can be depended upon as hardy, while *R. Purshiana* and *R. lanceolata* are hardy at least as far north as Massachusetts. *R. imeretina* and *R. caroliniana* are somewhat more tender. The handsomest in foliage are *R. fallax* and *R. imeretina* and the evergreen *R. ilicifolia* and *R. crocea*. *R. Purshiana*, *R. caroliniana*, *R. alnifolia*, *R. dahurica*, and *R. Frangula* are also noteworthy on account of pretty foliage. Of the evergreen species which are not

hardy North, *R. crocea* and *R. ilicifolia* are to be recommended for their ornamental bright red fruits. Buckthorns are useful for planting in shrubberies; they like a rather moist soil, especially *R. lanceolata*, *R. alnifolia*, *R. caroliniana*, and *R. Frangula*, and grow well in shaded or partly shaded situations, but *R. cathartica* and its allies prefer dry soil. *R. cathartica* is a valuable hedge plant, though it is now not used so extensively as in the past. The species are propagated by seeds stratified or sown in fall, and by layers. Some, as *R. lanceolata*, *R. fallax*, and *R. alnifolia*, are propagated by cuttings; *R. Purshiana*, has been successfully raised in England from softwood cuttings put in mild bottom heat under glass about the middle of July. The evergreen species are propagated by cuttings of ripened wood under glass. Rarer kinds are sometimes grafted, those of the *Frangula* group usually on *R. Frangula* and the true buckthorns on *R. cathartica* or allied species.

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<i>colchica</i> , 5.	<i>incana</i> , 11.	

KEY TO THE SPECIES.

- A. Winter buds scaly: petals usually 4, sometimes 5 or wanting: seeds (not the outer coating of the nutlet) sulcate or concave on the back, with thin cotyledons recurved at the margins: fls. imperfectly dioecious. (*Eurhamnus*.)
 - B. Lvs. opposite: spiny shrubs.
 - C. Shape of lvs. ovate to oblong.
 - D. Length of lvs. $1\frac{1}{2}$ –3 in.; lvs. broadly ovate to elliptic, thin. 1. *cathartica*
 - DD. Length of lvs. $2\frac{1}{2}$ –4 in.; lvs. oblong-elliptic to oblong, leathery. 2. *dahurica*
 - CC. Shape of lvs. obovate, cuneate at the base. 3. *japonica*
 - BB. Lvs. alternate: unarmed shrubs.
 - C. Foliage deciduous.
 - D. Pairs of veins 12–25.
 - E. Branchlets and lvs. beneath glabrous. 4. *fallax*
 - EE. Branchlets and lvs. beneath pubescent. 5. *imeretina*
 - DD. Pairs of veins 4–9.
 - E. Fls. 5-merous, apetalous: lvs. oval. 6. *alnifolia*
 - EE. Fls. 4-merous, with petals: lvs. oblong-lanceolate. 7. *lanceolata*
 - CC. Foliage evergreen.
 - D. Veins 5–9 on each side: lvs. $\frac{1}{2}$ –1 $\frac{1}{2}$ in. long: fls. apetalous.
 - E. Lvs. glandular denticulate: fls. 4-merous. 8. *crocea*
 - EE. Lvs. spinulose-dentate: fls. often 5-merous. 9. *ilicifolia*
 - DD. Veins 3–5 on each side: lvs. $\frac{1}{4}$ –2 in. long: fls. 5-merous, with petals. 10. *Alaternus*
 - AA. Winter buds naked: petals 5: seeds convex at the back, not grooved, with flat and fleshy cotyledons: unarmed shrubs with alternate lvs. (*Frangula*.)
 - B. Fls. in peduncled umbels.
 - C. Foliage evergreen. 11. *californica*
 - CC. Foliage deciduous.
 - D. Apex of lvs. obtuse or short-acuminate.
 - E. Peduncles usually longer than the petiole: lvs. with 6–15 pairs of veins, usually obtuse. 12. *Purshiana*

- BB. Peduncles usually shorter than the petiole: lvs. with 5-10 pairs of veins, usually acutish or short-acuminate. 13. *caroliniana*
 DD. Apex of lvs. usually long-acuminate: lvs. pubescent beneath at least on the veins. 14. *crenata*
 BB. Fls. in sessile umbels 15. *Frangula*

1. *cathartica*, Linn. BUCKTHORN. HART'S-THORN. WAYTHORN. RHINEBERRY. Fig. 3370. Shrub or small tree, attaining 12 ft., usually thorny: lvs. oval to elliptic or ovate, usually rounded at the base or cordate, obtuse



3370. *Rhamnus cathartica*. (X1/4)

or acute, crenulate-serrate, beneath green, glabrous or pubescent, $1\frac{3}{4}$ -3 in. long: fls. in 2-5-fl. clusters, with 4 petals: fr. black, about $\frac{1}{4}$ in. across; seed with a furrow usually open only at the base. Eu., W. and N. Asia; often escaped from cult. and naturalized in the E. U. S. B.B. (ed. 2) 2:502. Gng. 9:2. H.W. 3, p. 56.

2. *dahurica*, Pall. (*R. cathartica* var. *dahurica*, Maxim.). Fig. 3371. Large, spreading shrub, with stout thorny

branches, sometimes a tree, to 30 ft.: branchlets glabrous: lvs. oblong or sometimes elliptic, narrowed at the base, acuminate, crenulate-serrate, glabrous, grayish green beneath, somewhat coriaceous at maturity, 2-4 in. long: fls. and fr. similar to those of the preceding species, but fr. somewhat larger. Dahuria to Amurland and N. China. G.F. 9:425 (as *R. crenata*; adapted in Fig. 3371).—Sometimes cult. under the name of *R. crenata*. Var. *nipponica*, Makino. Lvs. narrow-oblong, light green beneath, 2-6 in. long and 1-2 in. broad. Japan.

3. *japonica*, Maxim. Spreading shrub with thorny branches, to 10 ft.: branchlets yellowish or grayish brown, lustrous: lvs. slender-stalked, obovate to oblong-obovate, short-acuminate, cuneate at the base, serrulate, sparingly pubescent or glabrous beneath, with 4-5 pairs of veins, 2-3 in. long: fls. in axillary clusters: fr. black, $\frac{1}{4}$ - $\frac{1}{2}$ in. across; seed usually with closed furrow. Japan. S.I.F. 2:48.

4. *fallax*, Boiss. (*R. alpina*, Auth., not Linn.). Shrub, to 10 ft., with stout, upright, glabrous and reddish brown branches: lvs. elliptic-oblong to oblong or obovate-oblong, cordate or rounded at the base, abruptly acuminate, crenulate-serrate, with 12-20 pairs of veins, dark green above, pale green and glabrous or nearly so beneath, 3-5 $\frac{1}{2}$ in. long: fls. in 3-7-fl. clusters; petals 4: fr. globose, black, $\frac{1}{4}$ in. across or less. Mountains of S. and Cent. Eu.—This and the following species are the handsomest of the deciduous-lyd. buckthorns because of the large size of their lvs.

5. *imeretina*, Koehne (*R. colchica*, Somm. & Lev. *R. alpina* var. *colchica*, Kuhn. *R. alpina* var. *grandifolia*, Dipp. *R. libanotica*, Hook. f., not Boiss. *R. grandifolia*, Hort., not Fisch. & Mey. *R. castanefolia*, Hort.). Allied to the preceding, but larger in every part: shrub, attaining 10 ft.: branchlets and petioles pubescent: lvs. larger and longer, to 8 in. long, pubescent beneath and often bronze-colored at maturity, with 15-25 pairs of veins. Caucasus, W. Asia. B.M. 6721. M.D.G. 1906:405.

6. *alnifolia*, L'Her. Low, wide-spreading shrub, attaining 4 ft., with puberulous branchlets: lvs. ovate to oval, obtuse or acuminate, usually narrowed at the base, crenately serrate, glabrous, $1\frac{1}{4}$ -4 in. long: fls. in few-fl. clusters, 5-merous, without petals: fr. globose, black, with 3 nutlets. New Bruns. and N. J. to Brit. Col. and Calif. B.B. (ed. 2) 2:503.

7. *lanceolata*, Pursh. Tall, upright shrub, with puberulous branchlets: lvs. ovate-lanceolate to oblong-lanceolate, acuminate or obtusish, finely serrulate, glabrous or somewhat pubescent beneath, 1-3 $\frac{1}{4}$ in. long: fls. in few-fl. clusters, with 4 petals: fr. with 2 nutlets. Pa. to Ala., Texas, and Neb. B.B. (ed. 2) 2:503.

8. *crocea*, Nutt. RED-BERRY. Evergreen shrub to 3 ft., with rigid often spinescent branches: lvs. orbicular to oblong-obovate, glandular-denticulate or serrulate, dark green and lustrous above, bronse- or copper-colored and glabrous or slightly pubescent beneath, $\frac{1}{4}$ - $\frac{3}{4}$ in. long: fls. in few-fl. clusters, 4-merous, apetalous: fr. bright red, about $\frac{1}{4}$ - $\frac{1}{2}$ in. across, edible. Calif.

9. *ilicifolia*, Kellogg (*R. crocea* var. *ilicifolia*, Greene). Evergreen shrub or small tree, to 12, or sometimes to 20 ft., with rather stout scarcely spinescent branches: lvs. oval to orbicular, spinulose-dentate, dark green and lustrous above, often golden beneath, $\frac{1}{4}$ -1 $\frac{1}{2}$ in. long: fls. often 5-merous, apetalous: fr. bright red, ovoid, $\frac{1}{4}$ in. long. Calif. S.S. 2:59 (as *R. crocea*).—This is superior to the preceding species on account of the more plentiful and somewhat larger bright red berries, also the lvs. are larger and resemble those of *Prunus ilicifolia*.

10. *Alaternus*, Linn. Evergreen shrub or small tree, attaining 20 ft., with glabrous branches: lvs. oval or ovate to ovate-lanceolate, acute, serrate or almost entire, glossy and dark green above, pale or yellowish green beneath, glabrous, $\frac{3}{4}$ -2 in. long: fls. in short racemes, with 5 petals: fr. bluish black. S. Eu. H.W. 3, p. 59. Var. *angustifolia*, DC. (*R. angustifolia*, Hort.), has narrower, oblong-lanceolate lvs. There are also varieties with variegated foliage.

11. *californica*, Esch. (*R. oleifolia*, Hook. *R. Purshiana* var. *californica*, Rehd.). COFFEE-BERRY. Evergreen shrub, to 15 ft.: lvs. oblong to oblong-lanceolate, acute or short-acuminate, serrulate or entire, glabrous and yellowish green beneath, 1-4 in. long: peduncles longer than petioles: fr. depressed-globose, changing from red to purplish black, about $\frac{1}{2}$ in. across. S. Ore. and Calif. to Ariz. and New Mex. R.H. 1874, p. 354. S.S. 2:63, fig. 3. Var. *tomentella*, Brew. & Wats. (*R. Purshiana* var. *tomentella*, Brandeg. *R. tomentella*, Benth. *R. incana*, Carr. *Frangula californica* var. *tomentella*, Gray). Allied to the preceding variety, but lvs. densely white-tomentose beneath. R.H. 1858, p. 658; 1872, p. 194. S.S. 2:63, fig. 2.

12. *Purshiana*, DC. CASCARA SAGRADA. Tall shrub to medium-sized tree, occasionally attaining 40 ft.: young branchlets pubescent or tomentose: lvs. elliptic to ovate-oblong, acute or obtuse, usually denticulate, with often wavy margin, dark green above, glabrous or pubescent beneath, 1-7 in. long: peduncles longer than petioles: fr. globose, changing from red to black, about $\frac{1}{2}$ in. across, with 2-3 nutlets. Brit. Col. to Mont., Idaho, and N. Calif. S.S. 2:62, 63.—Cascara Sagrada bark is extensively collected in Ore. and Wash. for use in drug manufacture.

13. *caroliniana*, Walt. INDIAN CHERRY. Shrub or small tree, attaining 30 ft.: young branches puberulous: lvs. elliptic to oblong, acute or acuminate, obscurely serrulate or almost entire, lustrous and dark green above, glabrous or nearly so, somewhat leathery at length, 2-6 in. long: peduncles shorter than petioles: fr. globose, about $\frac{1}{2}$ in. across, red changing to black, sweet, with 3 nutlets. N. Y. to Fla., west to Neb. and Texas. S.S. 2:61. B.B. (ed. 2) 2:503.

14. *crenata*, Sieb. & Zucc. Shrub, to 10 ft.: young branchlets and young lvs. rusty pubescent: lvs. oblong-ovate to oblong-lanceolate or obovate-oblong, acuminate or long-acuminate, finely crenate-serrulate, pubescent beneath, at least on the veins, with 7-12 pairs of veins, 2-4 in. long: peduncles usually shorter than petioles: fr. subglobose, $\frac{1}{2}$ in. across, changing from red to purplish black. Japan to Cent. China. S.I.F. 2:47.

15. *Frángula*, Linn. (*Frángula Álnus*, Mill.). Shrub or small tree, attaining 12 ft.: lvs. broadly obovate to obovate-oblong, acute, entire, dark green above, glabrous, 1-2½ in. long: fr. red, changing to black, with 2 nutlets. Eu., N. Afr., W. Asia and Siberia, escaped from cult. in some localities in the eastern states. Gng. 8:3. B.B. (ed. 2) 2:504. H.W. 3:48. Var. *asplenifolia*, Dipp. (*R. asplenifolia*, Simonkai, not Carr.). Lvs. linear, undulate; an interesting form of very distinct appearance with its feathery foliage. Var. *latifolia*, Dipp. (*R. latifolia*, Kirchn., not L'Her.). Lvs. to 5 in. long and to 2½ in. broad: fr. larger. Var. *heterophylla*, Mouillef. (var. *angustifolia*, Bean). Lvs. oblong to lanceolate, uneven, erose or irregularly lobed at the margin.—*R. Frangula* is a handsome shrub with shining foliage and attractive berries.

R. alpina, Linn. Closely allied to *R. fallax*. Young branchlets dull brownish gray, often pubescent: lvs. elliptic or oval, with 10-12 pairs of veins, 1½-3, rarely to 4 in. long: fr. smaller. Mountains of S. Eu. L.B.C. 11:1077.—*R. arguta*, Maxim. Unarmed glabrous shrub, allied to *R. cathartica*: lvs. opposite, orbicular-ovate, acuminate, sharply serrate, with bristly pointed teeth. Amurland. Probably hardy.—*R. Billardii*, Hort.=*R. hybrida* var.—*R. chlorophora*, Koehne (*R. chinensis*, Hort.). Shrub: branchlets glabrous or nearly so; lvs. obovate, abruptly acuminate, pubescent on the veins beneath, with 4-6 pairs of veins, 1½-3 in. long. China. Doubtful species.—*R. chlorophora*, Deene.=*R. globosus*.—*R. costata*, Maxim. Allied to *R. fallax*. Shrub, to 15 ft.: branchlets glabrous: lvs. elliptic or ovate-oblong, crenately serrulate, with about 20 pairs of veins, pubescent beneath, 3-6 in. long; petiole very short: fr. black, $\frac{1}{2}$ in. across. Japan. S.I.F. 2:48.—*R. crenulata*, Ait. Evergreen shrub: lvs. oblong, obtusish, narrowly cuneate at the base, crenulate, glabrous, $\frac{1}{4}$ -1¼ in. long: fls. in dense clusters in the axils of last year's lvs. Canary Is. Tender.—*R. dumetorum*, Schneid. Spiny shrub, to 6 ft.: lvs. usually opposite, rhombic-lanceolate, acute at the ends, or elliptic, crenate-denticulate, pubescent at least on the veins beneath, $\frac{1}{3}$ -1¼ in. long: fr. $\frac{1}{4}$ in. thick. W.

China. Var. *crenoserda*, Rehd. & Wilson. Lvs. 1¼-2¼ in. long, more coarsely crenate-serrate. W. China.—*R. erythrocylon*, Pall. Unarmed shrub, allied to *R. cathartica*: lvs. alternate, oblong-lanceolate to linear. Caucasus to Mongolia and Siberia. Hardy.—*R. globosa*, Bunge (*R. chlorophora*, Deene, *R. dahurica* var. *aprica*, Maxim.). Low rigid shrub: branchlets pubescent: lvs. opposite, obovate or broadly obovate, cuneate, pubescent, $\frac{1}{2}$ -2 in. long: fr. $\frac{1}{4}$ in. thick. N. and E. China.—*R. heterophylla*, Oliver. Shrub, to 5 ft. with often decumbent branches: branchlets pubescent: stipules persistent: lvs. alternate, ovate-lanceolate, $\frac{1}{2}$ -1¼ in. long or broadly ovate, $\frac{1}{4}$ -¾ in. long, puberulous on the veins beneath: fls. 5-merous. Cent. China. H.I. 18:1759.—*R. hybrida*, L'Her. (*R. Alaternus* × *R. alpinus*). Half-evergreen shrub, with alternate, oval-oblong, glossy lvs. Var. *Billardii*, Lav. Lvs. narrower, more remotely serrate. Half-hardy shrub, with handsome glossy foliage.—*R. infectoria*, Linn. Spiny spreading shrub, to 6 ft.: lvs. subopposite, oval or ovate to obovate, finely toothed, glabrous or pubescent on the veins beneath, $\frac{1}{2}$ -1½ in. long: fr. black. S.W. Eu.—*R. latifolia*, L'Her. Allied to *R. Frangula*: lvs. larger, elliptic-oblong, with 12-15 pairs of veins, 4-7 in. long: fr. $\frac{1}{4}$ -¾ in. thick, changing from red to black. Azores. B.M. 2863. I.T. 3:106. G.W. 12, p. 312. Not hardy.—*R. leptophylla*, Schneid. Shrub, to 6 ft.: branchlets glabrous: lvs. opposite, obovate, short-acuminate, remotely denticulate, light green, glabrous beneath, 1¼-3 in. long: fr. $\frac{1}{4}$ in. thick. Cent. and W. China.—*R. libanotica*, Boiss. Allied to *R. imeretina*; more spreading: lvs. oblong-obovate, crenate-dentate, pubescent beneath, with 10-15 pairs of veins: fr. $\frac{1}{4}$ in. across. Asia Minor.—*R. pumila*, Linn. Low, sometimes procumbent shrub, allied to *R. alpinus*, with smaller and shorter lvs., usually narrowed at the base. Eu., Alps. Hardy.—*R. Rostkornii*, Pritz. Shrub, to 5 ft.: branchlets glabrous: lvs. opposite, oblong-lanceolate, cuneate, crenate, pubescent beneath, $\frac{1}{4}$ -1 in. long: fr. $\frac{1}{4}$ in. across, with usually 2 seeds. W. China.—*R. rupetris*, Scop. Low, often procumbent shrub, about 3 ft. high, allied to *R. caroliniana*: lvs. ovate to oblong-obovate, thin, 1-3 in. long: umbels 1-3-fld. Alps of E. Eu.—*R. Sargentiana*, Schneid. Shrub, to 15 ft.: branchlets glabrous: lvs. alternate, oblong-elliptic, cuneate, acute or short-acuminate, crenate-serrate, sparingly hairy beneath, with 12-18 pairs of veins, 1¼-5 in. long: fr. purplish black, $\frac{1}{4}$ in. across. W. China.—*R. saxatilis*, Linn. Low and dense, very spiny shrub, about 3 ft. high, allied to *R. cathartica*: lvs. opposite or alternate, oval or obovate, glabrous, about 1 in. long. Mountains of Cent. and S. Eu., W. Asia. Hardy. H. W. 3, p. 57.—*R. spatulifolia*, Fisch. Spiny shrub, to 6 ft.: lvs. alternate, elliptic-oblong to lanceolate, narrowed at both ends, finely toothed, glabrous or finely pubescent, $\frac{1}{4}$ -2 in. long: fr. black, slender-stalked. S. E. Eu., W. Asia.—*R. tinctoria*, Waldst. & Kit. Closely allied to the preceding, but lvs. pubescent. Mountains of Cent. and S. Eu., W. Asia.—*R. utilis*, Deene. Shrub to 10 ft.: branchlets glabrous: lvs. opposite, elliptic-oblong, serrulate, light green, glabrous, with 5-8 pairs of veins, 2-5 in. long. Cent. and E. China.

ALFRED REHDER.

RHAPHIDOPHORA (Greek for *needle-bearing*; alluding to needle-like hairs). *Araceæ*. Climbing aroids, to be treated like Philodendron and Pothos. Species 60 in Engler, Pflanzenreich, hft. 37 (IV. 23B. 1908), of the East Indies, allied to Pothos, but distinguished by the presence of odd hairs in the intercellular spaces and by the two-loculed rather than three-loculed ovary. The garden plant *Pothos aureus*, sometimes provisionally referred here, is to be sought in Scindapsus. The generic name is sometimes spelled *Raphidophora*.

It is not known that any species of *Rhaphidophora* are in the American trade. *R. pertusa*, Schott (*Pothos pertusus*, Roxbg. *Scindapsus pertusus*, Schott), has large monstera-like lvs., with long and narrow side lobes and numerous holes in the blade. R.H. 1883, p. 561. *R. decursiva*, Schott, is a gigantic climber, with large pinnate lvs., the segms. or lfts. oblong-lanceolate-acuminate and strongly nerved: spathe yellowish. B.M. 7282. *R. Peëpla*, Schott, has entire oblong or elliptic-oblong lvs., with roundish or subcordate base: spathe yellowish.

RHAPHITHAMNUS (Greek, *rhapsis*, needle, and *thamnos*, shrub; referring to the needle-like spines).

Verbenaceæ. Two evergreen small trees from Chile, with slender axillary spines, opposite, rather small, entire short-petioled lvs. and tubular lilac fls. axillary, solitary or in pairs on the spines, followed by bright blue globose berries: calyx tubular-campanulate, 5-toothed, persistent, becoming fleshy and inclosing the frs.; corolla tubular-funnelform, with short spreading unequally 5-lobed limb; stamens 4, didynamous, inclosed; ovary superior, 4-celled; style slender with 2-lobed stigma: fr. a fleshy drupe with two 2-celled and 2-seeded stones. The following species has recently been recommended as a hedge-plant for the warmer parts of the United States.



3371. *Rhamnus dahurica*. (× $\frac{3}{4}$)

R. cyanocarpus, Miers (*Citharixylon cyanocarpum*, Hook. & Arn. *R. parvifolius*, Miers). Tree, to 20 ft.: young branchlets pubescent; spines slender, $\frac{1}{2}$ –1 in. long: lvs. sometimes in 3's, ovate, acute, rounded at the base, entire, glabrous above and glabrous beneath except bristly hairs on the midrib, $\frac{1}{4}$ – $\frac{3}{4}$ in. long: fls. lilac, slender, about $\frac{1}{2}$ in. long: fr. globose, bright blue, $\frac{1}{3}$ – $\frac{1}{2}$ in. across. Chile. B.M. 6849.—A handsome densely leafy shrub, particularly ornamental when studded with its bright blue frs. ALFRED REHDER.

RHAPIDOPHYLLUM (Greek, probably means *Rhapis-leaved*). *Palmaceae*. BLUE PALMETTO. NEEDLE PALM. One species ranging from S. C. to Fla. It is a dwarf fan palm with erect or creeping trunk 2–3 ft. long, and long-stalked nearly round deeply and unequally cleft lvs. with about 15 segms.: spadices short-peduncled: spathes 2–5, entire, tubular, compressed, bifid, woolly: fls. minute, orange: fr. small, ovoid or obovate, woolly. The genus is closely allied to *Chamaerops* and is distinguished by having the albumen not ruminant and by the bracts at the base of the branches of the spadix being few or none. The plant is said to produce suckers freely, like *Rhapis*. Cult. as in *Rhapis*.

Rhapidophyllum hystrix, the blue palmetto or needle palmetto, is the most beautiful and elegant of our native dwarf palms. It is very local in its distribution, being found in rich low soil both in Georgia and Florida, but it is everywhere rather rare. Its most striking characteristics are the long sharp black spines projecting in every direction from the dark fibers which cover the trunk. These spines, which are often a foot long, seem to protect the inflorescence, which before opening resembles a large white egg and which is imbedded among the spines. This palm bears staminate and pistillate flowers on separate plants. The woolly clusters of fruit or seeds are borne on short stems also surrounded by the sharp spines. This palmetto is easily transplanted. The leaves are dark shiny green, relieved by a pale silvery gray on the under surface. It is a very beautiful plant, and groups of it are striking. The stem is 2 to 3 feet high and the leaves rise to a height of 3 to 4 feet. (H. Nehrling.)

hystrix, H. Wendl. & Drude (*Chamaerops hystrix*, Fraser). Fig. 3372. St. 2–3 ft., erect or creeping, proliferous, clothed with the fibrous remains of lf.-sheaths intermingled with long, erect spines: lvs. 3–4 ft., somewhat glaucous especially beneath, circular in outline, with numerous 2–4-toothed segms.; petiole triangular, rough on the margins; sheaths of oblique fibers interwoven with numerous strong, erect spines: spadix 6–12 in. long, short-peduncled: petals ovate, drupe $\frac{3}{4}$ –1 in. long. S. C. to Fla. I.H. 30:486.

JARED G. SMITH.

RHAPIS (Greek, *needle*: alluding to the shape of the leaves or perhaps the awns of the corolla). *Palmaceae*, tribe *Sabaleae*. Fan palms of very distinct habit, being among the few palms that produce suckers at the base, thereby forming bushy clumps.

Low palms, with leafy densely caespitose reedy sts. clothed with remains of the reticulate lf.-sheaths: lvs. alternate

and terminal, submembranaceous, connate or semi-orbicular, irregularly and digitately 3- to many-parted; segms. linear, cuneate, or elliptical truncate, entire, dentate or lobed; nerves 3 to many; transverse veins conspicuous; rachis none; ligule very short, semi-circular; petiole slender, biconvex, smooth or serrulate on the margins; sheath long, loosely fringed on the



3373. *Rhapis humilis*.

margin: spadices shorter than the lvs., slender-peduncled: rachis sheathed by deciduous bracts: branches spreading: spathes 2–3, incomplete, membranous: fls. yellow.—About 5 species, natives of China and Japan. This genus is distinguished from its near allies (for a list of which see *Licuala*) by the fls. being dioecious; corolla 3-toothed; anthers dehiscing extrorsely. The name *Rhapis* is commonly spelled and pronounced *Raphis*, but this is incorrect. They can be grown in temperate house with a night temperature of 55–60°. The soil should be good loam 3 parts, leaf-mold 1 part and sand 1 part. Prop. by imported seeds or by the freely produced suckers. Hardy in S. Calif. and S. Fla., and, in fact, the hardest of all the palms with the exception of certain species of *Sabal* and *Chamaerops*.

A. Sts. $1\frac{1}{2}$ –4 ft. high.

B. Lvs. with 5–7 segms.

flabelliformis, L'Her. (*R. Kwaniwortsik*, Wendl.). Fig. 2739. Sts. $1\frac{1}{2}$ –4 ft. high: lvs. 5–7-parted; segms. linear, subplicate, ciliate-spinulose along the margins and midveins, truncate, erose at the apex; petioles serrulate along the margins. China, Japan. B.M. 1371. R.H. 1872, p. 230. A.G. 13:261. I.H. 34:13. G. 1:478; 23:614. Gn.M. 6:288. Var. *intermedia*, Hort., according to Siebrecht, has lvs. horizontal instead of somewhat erect. Var. *variegata*, Hort., has been offered.

BB. Lvs. with 7–10 or more segms.

humilis, Blume. Fig. 3373. Almost stemless, but producing a few short reed-like sts.: lvs. semi-circular; basal lobes directed backward; segms. rarely more than 10, spreading; petioles unarmed. China. A.F. 7:405; 22:475.



3372. Young leaf of blue palmetto, not yet unfolded. (× $\frac{1}{4}$)

AA. *Sts. becoming 8 ft. high.*

cochinchinensis, Mart. (*Chamærops cochinchinensis*, Lour.). *Sts.* often 6-8 ft.: lf.-segs. much plaited, oblong, obtuse; petioles short, straight and prickly. Cochín-China. Intro. by Franceschi, 1900.

N. TAYLOR.†

RHAPONTICUM (old Greek name for rhubarb, the same as occurs in *Rheum Rhaponticum*). *Compositæ*. Under this generic name at least one species is still catalogued, although the genus is now included as a section of *Centaurea*. Nine species are recognized in the group, extending from Morocco and Algiers to China. They are more or less thistle-like stout herbs, mostly or entirely perennial, with large solitary yellow, pink or purplish heads, the lvs. usually white-tomentose beneath: florets all equal and perfect: fr. 4-angled; pappus rough or feathery. Two species may be described here, under the genus *Centaurea*. *C. Rhaponticum*, Linn. (*Rhaponticum scariodum*, Lam.). Perennial, 2-2½ ft., with purplish fl.-heads: lvs. tomentose beneath, glabrous above, the lower ones ovate or cordate and finely toothed, petiolate, the upper ones sessile and oblong: outer scales of involucre scarious (dry). Alps, Switzerland. B.M. 1752. Appears not to be offered. *C. cynaroides*, Link (*R. cynaroides*, Less.). Perennial, from the Pyrenees region: heads few and erect, purplish-fl.: lvs. large, oblong to ovate, attenuate at base, acuminate, the lower ones pinnately parted, the upper scarcely pinnatifid, all the lobes acutely toothed, more or less tomentose beneath: scales of involucre ciliate-serrate.—Listed abroad for outdoor planting.

L. H. B.

RHEEDIA (named after H. van Rheede 1635-1691). *Guttiferæ*. Trees, full of yellow sap, some of them with edible fruit.

Leaves rigid, leathery, lightly feather-veined: peduncles axillary or lateral, the male fascicled, the female fewer: fls. often small, polygamous-diceious; sepals 2, often connate at the base; petals 4, decussately imbricated; ovary 3- (rarely 4-5-) celled: berry corticose and indehiscent.—About 30 species, Trop. Amer.

brasiliensis, Planch. & Triana. Lvs. coriaceous, ovate or oblong-ovate, obtuse and narrowed at the base to a short petiole, apex obtuse or rather acute: fls. numerous, in axillary clusters, polygamous: berry obovate, short-beaked. Brazil and Paraguay.—Intro. into Calif.

edulis, Planch & Triana. Very smooth tree: lvs. lanceolate-oblong or oblong, acuminate, base acute or attenuate: fls., the fertile ones, axillary, the pedicels shorter than the fr.: drupe oblong, yellow. Cent. Amer.—Intro. into Calif.

macrophylla, Planch. & Triana. Lvs. broad-lanceolate or lanceolate-oblong, acute at both ends, leathery: fls. axillary, fascicled, 4-8; the pedicels twice the length of the fls.: berry ovate. S. Amer.

F. TRACY HUBBARD.

RHEUM (*Rha* was the old Greek name for rhubarb). *Polygonaceæ*. RHUBARB. Perennial (sometimes monocarpic) herbs grown for the large bold foliage and often interesting inflorescence; and one for the edible leaf-stalks.

Leaves mostly radical, large for the size of the plant, entire or divided, on stout thick petioles: sts. mostly strict and rising above the heavy foliage, often tall, making plants of striking habit: fls. perfect, small, greenish or whitish, pedicellate, in numerous panicked fascicles or racemes, the infl. elevated on stout mostly hollow scape-like sts., which are provided with sheathing stipules or ochreae (Fig. 3374); perianth 6-parted and spreading; stamens 9 or 6; ovary 3-angled and bearing 3 styles, ripening into a winged or sometimes nearly succulent achene.—Species about 25, Syria and Siberia to China, through the Himalayan region.

Aside from the common rhubarb, *Rheum Rhaponticum*, which is grown for the edible leaf-stalks, the species are little known in general cultivation. Few plants are more useful, however, for bold and striking foliage effects; and these effects are heightened by the towering flower-panicles. Most of the species are hardy and easy to grow, but they profit by a liberal winter mulch. Rheums are usually seen to best advantage against a heavy background of foliage or of rock (Fig. 1817, p. 1463). Even the common rhubarb is a useful ornamental subject when well placed. In order to secure large and fine foliage, the soil should be rich and moist. The species are propagated by dividing the root-masses, preferably in spring, leaving as much root as possible with each strong eye or bud.



3374. Ochrea or stipular sheath of rhubarb.—*Rheum Rhaponticum*. ($\times \frac{1}{4}$)

The dried rhizomes of rhubarb are used medicinally. Several species afford the official product. The larger part of the dried rhubarb imported from the Orient is probably made from the crown or short stem (not the flower-stem) of *R. officinale*. *R. Rhaponticum* is sometimes grown for its medicinal roots.

A. *St. or scape with large imbricating lvs. or bracts.*

Alexandrae, Veitch. Tall, the fl.-sts. reaching 3-4 ft., bearing great pale yellow overlapping leaf-like rather obtuse bracts well above the dark glossy green and relatively small elliptic-ovate crown-lvs. Thibet, W. China. R.B. 35, p. 297. J.H. III. 61:297.—A striking plant of recent intro.

AA. *St. or scape without prominent imbricating foliage.*

B. *Foliage undivided, the margins of the lvs. nearly or quite entire.*

C. *Lvs. (at least on the fl.-stalks) acute or acuminate.*

Rhaponticum, Linn. (i. e., *Pontic Rha*, "Rhubarb of Pontus," a province of Asia Minor). RHUBARB. PIE-PLANT (in the U. S.). WINE-PLANT. Fig. 3374. Strong perennial, with thick clustered roots: petioles semicylindric, plane above: lf.-blades suborbicular, deeply cordate at base, undulate, about 5-ribbed, glabrous and shining above, pubescent on the veins beneath: panicles tall and narrow, somewhat leafy, densely flowered, the pedicels jointed below the middle, the fls. whitish: achene oblong-oval. In deserts and subalpine parts of S. Siberia.—Nearly everywhere grown in this country for the succulent acid petioles or leaf-stalks, which are used in early spring for pies and sauces. Wine is sometimes made from the juice. In France, known usually as an ornamental plant. There are several garden varieties. See *Rhubarb*.

undulatum, Linn. St. 4-5 ft., smooth: petioles semiterete, lightly channeled above, the lf.-blades ovate-cordate and strongly undulate (basal sinus not so deep as in *P. Rhaponticum*), 5-7-ribbed, glabrous above and puberulent beneath, the upper ones long: panicle narrow and leafy below, the pedicels jointed near the base: achene ovate or oval. Siberia.—Earlier and usually smaller than *R. Rhaponticum*.

CC. *Lvs. obtuse or essentially so.*

emodi, Wall. St. tall and leafy, 5-10 ft.: petioles semiterete, somewhat concave above, the margins obtuse: lf.-blades large, ovate, cordate, obtuse, somewhat undulate, 5-7-ribbed, the under surface and the margin pubescent: panicles fastigiate branched, the fls. dark purple, pedicels jointed below the middle: achene large, ovate or oblong-oval. Himalaya, in alpine and subalpine regions.—Foliage has a coppery hue.

inopinatum, Prain. Small perennial of recent introduction: plant seldom more than 2 ft. high, the foliage clustered at the crown, the st. red and nearly leafless: lvs. orbicular-oval, gray-green, blades 6-9 in. long and nearly as broad, more or less blistered, not lobed but somewhat irregular-margined, obtuse, the petiole about 6 in. long and red-purple: infl. paniculate, bright red or crimson, produced in succession: fr. highly colored, the nutlets orbicular and 3-winged, nearly $\frac{1}{2}$ in. across.



3375. *Rheum officinale*, showing the foliage crown before flowering.

Thibet. B.M. 8190. G.C. III. 48:391.—A handsome small species, in condition nearly all summer, with attractive red-stalked and red-nerved foliage.

BB. Foliage more or less lobed, the margins of the lvs. or segms. usually toothed or notched.

C. Lvs. shallowly or obscurely lobed.

compactum, Linn. St. tall: petioles sulcate, plane above: lf.-blades thickish, broad-ovate, cordate, undulate and obscurely lobed, very obtuse, glabrous and shining above, the margin strongly toothed, the veins very prominent: panicle with drooping branches: achene large, dark-colored. Siberia to China.

CC. Lvs. deeply lobed or evenly divided.

palmatum, Linn. (*R. sanguineum*, Hort.). St. tall (5-6 ft.) and leafy: petioles subcylindrical, the margin rounded: lf.-blades broad, suborbicular and cordate, 3-5-ribbed, scabrous, deeply palmately lobed; the lobes ovate-oblong or lanceolate, acute, entire, dentate or pinnatifid: panicle leafy, with pubescent branches, the pedicels scarcely longer than the fls.: achene oblong-oval and subcordate. N. E. Asia. Var. *tanguticum*, Regel (*R. tanguticum*, Hort.). Lvs. more elongated and not so deeply lobed. G.Z. 20, p. 17. Var. *atrosanguineum*, Hort. (var. *floribus rubris*, Hort.), has a showy dark red panicle. Gn. 60, p. 10.

hybridum, Murr. Petiole long, canaliculate above and sulcate beneath: lf.-blades ovate, 3-5-ribbed, the base cuneate or scarcely cordate, incise-dentate, puberulent beneath: panicle lax, leafy: achene large, ovate.—Seems to be unknown wild. Perhaps a hybrid series between *R. palmatum* and *R. Rhaponticum* or *R. officinale*.

Colliniatum, Baill. Probably one of the *R. hybridum* series, with much-cut broad lobes that extend half the depth of the lf.-blade: fls. red. China.

officinale, Baill. Fig. 3375. Robust, with a short, branching st. or crown 4-10 in. high: lvs. very large, 1-3 ft. across, round-oval, more or less pointed or acuminate, hairy, 3-7-lobed, the lobes extending one-third or one-half the depth of the blade and sharply angled-notched: fl.-sts. 3-10 ft., much branched, bearing numerous greenish fls. that give a feathery effect to the panicle: achenes red, winged. Thibet and W. China, on high tablelands. B.M. 6135. R.H. 1874, p. 95. Gn. 36, p. 243; 48, pp. 199, 208; 59, p. 282. G.C. III. 55:328. G. 9:341; 18:428; 23, 452, 453.—Probably the best species of the genus for general cultivation

for ornament, making a striking foliage plant. It is from the short thick branching st. or caudex of this plant that most of the true official rhubarb is derived. Although known to the Chinese for centuries and the product long imported into Europe, the plant was not described botanically until 1872.

R. acuminatum, Hook f. & Thom. Dwarf plant (seldom exceeding 3 ft.), like a small form of *R. emodi*, with acuminate lvs., but fls. considerably larger: said to be an attractive plant in cult. but to die after flowering: sts. and infl. deep red-purple. B.M. 4877. G. 30:650.—*R. gunneroides*, Hort., is a garden hybrid, of German origin, between *R. emodi* and *R. palmatum*. Himalayas.—*R. nobile*, Hook f. & Thom. St. simple, 3-4 ft., densely clothed with imbricated downward-pointing bracts that conceal the short axillary peduncles: lvs. ovate-oblong or rounded, entire. When the fruit is ripe, the shingled bracts are torn away by the winds, leaving the long panicle exposed, and this may stand while another panicle grows from the crown and perhaps at some distance separated. Himalayas. R.H. 1876, p. 266. I.H. 22:209. G.C. II. 13:793. G.Z. 20, p. 104. A remarkable plant.—*R. Ribes*, Linn. 3-5 ft.: lvs. 1 ft. across, cordate to reniform, the margins crisped or undulate, the blade puckered or blistered: fls. green, drooping: frs. about 1 in. long, oblong-ovate, narrow-winged, blood-red, showy. Asia Minor to Persia. B.M. 7591. "Rivas" or "Ribes" is its Arabic name.—*R. epiciforme*, Royle. Dwarf: lvs. thick, orbiclar or broadly ovate: fls. white, in a dense spike rising about 2 ft. W. Himalaya.

L. H. B.

RHÉXIA (Greek, *rupture*, referring to its supposed properties of healing). *Melastomaceae*. MEADOW BEAUTY. Low perennial often bristly herbs suitable for border and wild-garden planting.

Leaves opposite, sessile or short-petioled: fls. terminal, solitary or cymose; calyx-tube urn-shaped, adherent to the ovary below, and continued above it, persistent, 4-cleft at the apex; petals 4, oblique, falling early; stamens 8: caps. 4-celled, with 4- to many-seeded placentae.—About 12 species. N. Amer.

Rhexia virginica is found wild in company with side-saddle plants (*Sarracenia purpurea*) and cranberries in the low meadows of Massachusetts. It is what would be called a bog-plant. It is a pretty, low-growing, tuberous-rooted plant blooming in summer and chiefly interesting as being one of few species of a genus belonging to a family almost wholly composed of shrubby plants from tropical countries, such as *Centradenia*, *Pleroma*, and *Medinella*. It increases by means of tubers and seeds, and under suitable conditions soon makes large clumps. Tubers potted in the autumn and kept in a coldframe force nicely in springtime. (T. D. Hatfield.)

A. St. cylindrical.

mariäna, Linn. A slender erect usually simple-stemmed plant with reddish purple fls. about 1 in. across, in loose cymes: lvs. short-petioled, oblong to linear-oblong, 1-1½ in. long, 2-5 lines wide, 3-nerved; anthers minutely spurred at the back. June-Sept. Pine barrens, N. J. to Fla., west to Ky. B.B. 2: 474.—Grows in drier places than *R. virginica*. It sometimes has white fls. and there is also a linear-lvd. form.



3376. *Rhexia virginica*. (X14)

AA. *St. angled.*

B. *Petals yellow.*

lutea, Walt. *St.* becoming much branched, 1 ft. high: lvs. smooth, serrulate, the lower obovate and obtuse, the upper lanceolate and acute: fls. small, in numerous cymes. July, Aug. Pine-barren swamps, N. C. to Fla. and west.

BB. *Petals not yellow.*

C. *Lvs. 6-10 lines long.*

ciliata, Michx. *St.* nearly simple, 1-2 ft. high: lvs. ovate, sessile or very short-petioled, 3-nerved: fls. violet-purple, 1-1½ in. across, short-pedicelled, in few-fl. cymes; anthers not curved and not spurred at the back. June-Aug. Swamps, Ind. to Fla., west to La.

CC. *Lvs. 1-2 in. long.*

virginica, Linn. Fig. 3376. Roots tuber-bearing: sts. about 1 ft. high, branched above and usually clustered, forming a compact, bushy plant: lvs. sessile, ovate, acute, rounded or rarely narrowed at the base, 1-2 in. by ½-1 in., usually 5-nerved: fls. rosy, 1-1½ in. across, in cymes; petals rounded or slightly retuse; anthers minutely spurred on the back. July-Sept. Sunny swamps, Maine to Fla., west to Mo. B.B. 2:474. B.M. 968.—This is one of the prettiest of the small wild fls. When transplanted, it seems to thrive as well in good clay loam as in peaty soils, although it sometimes grows in the latter.

F. W. BARCLAY.

F. TRACY HUBBARD.†

RHIPIDODENDRON: *Aloe*.

RHIPIDÓPTERIS (from Greek for *division* and *Pteris* for *fern*). *Polypodiaceæ*. A tropical American genus of small ferns formerly classed under *Acrostichum* which it resembles in having the fertile lf.-blades entirely covered with sporangia. It differs in having the sterile lvs. dichotomously divided into linear lobes unlike any other fern.

pellata, Schott (*Acrostichum pellatum*, Swartz). Rootstocks long-creeping: sterile lf.-blades 1-2 in. each way on slender stalks 2-4 in., repeatedly forked into very narrow divisions; fertile lf.-blades ¼-½ in. wide, circular, or somewhat 2-lobed. Mex. and W. Indies to Brazil.—A delicate and distinct plant, needing moisture all the year round especially in the air. Avoid unnecessary disturbances of roots. Use some partly decayed leaf-mold.

R. C. BENEDICT.

RHÍPSALIS (Greek, *rhíps*, wicker-work). Includes *Lepismium*. *Cactaceæ*. Epiphytic plants of rather diverse form, sometimes grown in glasshouse collections of succulents and cacti.

Flowers very small, usually without tube; stamens and style very short: fr. small naked berries.—A genus of about 50 species, mostly confined to S. Amer. Excludes *Hariota* and *Pfeiffera* of Cyclo. Amer. Hort. Cult.

similar to epiphyllum and zygocactus. They are mostly fancier's plants and grown by collectors, for the interesting habit and characteristic kinds of branching.

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A. *Bracts on ovary with hairs and bristles in their axils.*

1. *pilocarpa*, Löfgren. Branches terete, the axils bearing 10-15 white bristles: fls. wheel-shaped, 1 in. broad. Brazil.

AA. *Bracts on ovary naked.*

B. *Ovary imbedded in the branch.*

C. *Edges of joints winged.*

2. *squamulosa*, Schum. (*Lepismium commune*, Pfeiff.). Somewhat branched, reaching a length of 2 ft.: branches very unequal in length, ½-1 in. thick, triangular, the angles winged: fls. 1-2, from the deep areoles, 5 lines long, greenish without, yellowish within. Brazil, Argentina. B.M. 3763.

CC. *Edges of joints not winged.*

3. *myosurus*, Schum. (*Lepismium myosurus*, Pfeiff.). Somewhat branched, a yard long: branches 3-6 lines thick, 3-4-angled, the angles not winged, the terminal branchlets generally acuminate, often tipped by a pencil of bristles: fls. solitary in the deep areoles, 4-5 lines long, rosy white: fr. red. Brazil. B.M. 3755.

BB. *Ovary not imbedded in the branch.*

C. *Branches terete, slender.*

D. *The branches of 2 kinds.*

4. *Saglionis*, Otto (*R. brachiata*, Hook. *Hariota Saglionis*, Lem.). Fig. 3377. Reaching a height of 2 ft., richly branched: long or cereiform branches ½-1 ft. long; secondary or fruiting branches oblong-elliptic or short-cylindric, rounded at the ends, spirally or rarely verticillately arranged, sometimes weakly grooved, not more than ½ in. long: areoles with very scanty wool and



3377. *Rhipsalis Saglionis*. (×¼)

2-4 short bristles, which on the end branches project as a little brush: fls. near the tops of the short branches, flat, $\frac{3}{4}$ in. diam., with 12 white lvs. with yellowish mid-stripe: berry white. Uruguay and Argentina. B.M. 4039.

5. *mesembrianthemoides*, Haw. (*Haridta mesembrianthemoides*, Lem.). Upright, the ends drooping, richly branched: long branches 4-8 in. long, 1 line diam.; fruiting branches 3-5 lines long, not more than 2 lines diam., spirally attached, thickly crowded: areoles sparsely woolly, with 1-2 bristles which project from the ends of the branches: fls. near the top of the joint, about 5 lines diam., formed of 10 white with yellow midstriped lvs.: berry white. Brazil. B.M. 3078.—Probably hardly more than a slender variety of the preceding species.

6. *gracilis*, N. E. Br. Branches terete, slender: fls. either terminal or lateral, minute. Passing in collections under the name of *R. penduliflora*.

DD. *The branches all alike.*

7. *grandiflora*, Haw. (*R. fundis*, Salm-Dyck). Branching, cylindrical, rather stout, the branches reaching a height of 3 ft., with a diam. of more than $\frac{1}{2}$ in.; ultimate branchlets short, often verticillate: areoles depressed, bordered by a red line, sometimes in old branches bearing a bristle: fls. wheel-shaped, lateral on the branches, nearly 1 in. diam. Brazil. B.M. 2740.

8. *Cassytha*, Gaertn. Richly branching, pendulous, sometimes 10 ft. long; branches rarely 2 ft. long, 1-1 $\frac{1}{2}$ lines diam., pale green; ultimate branchlets spirally attached: areoles with sparse woolly hairs and frequently 1-2 minute bristles: fls. lateral on the terminal joints, 2-3 lines diam.: berry like that of the mistle-toe, 1-2 lines diam. Widely dispersed in Cent. and S. Amer., W. Indies, Mex., Mauritius, Ceylon, and Afr. B.M. 3080.

9. *virgata*, Web. Richly branching, pendulous, becoming a yard long; terminal branchlets hardly more than a line thick, spirally attached: areoles bearing sparse woolly hairs, with an occasional bristle: fls. lateral, 3-4 lines diam.: berry only 1 $\frac{1}{2}$ lines diam. Brazil.—Very much like the preceding.

CC. *Branches not terete.*

D. *The branches narrow, angled.*

10. *trigona*, Pfeiff. Richly branched, becoming a yard long; branches $\frac{1}{2}$ to nearly 1 in. diam., 3-angled: areoles sparsely woolly and bristly, the blooming areoles much more copiously so: fls. greenish outside, white within, 4 or 5 lines long. Brazil.

11. *paradoxa*, Salm-Dyck. Sparingly branched, 1-2 ft. long; branchlets 1-2 in. long and $\frac{1}{2}$ -1 in. diam., twisted at the joints, so that the angles alternate with the sides: fls. $\frac{3}{4}$ in. long, white. Brazil.

12. *pentaptera*, Pfeiff. Richly branched, 1-2 ft. long, 4-5 lines diam.: branchlets 2-5 in. long, 5-6-angled or almost winged: areoles in crenatures of the angles with scanty wool and an occasional bristle: fls. greenish white, 3-4 lines long; fr. white, bright rose-red above, crowned by the withered fl. S. Brazil, Uruguay, Argentina.

13. *rösea*, Lagerheim. Shrubby, more or less erect, usually 10 in. high: branches clustered, often hanging, 3-4-angled: fls. rare, large, 1 $\frac{1}{2}$ in. broad, rose-colored, fragrant. Brazil.

DD. *The branches usually flat or 3-angled, always broad.*

14. *rhombea*, Pfeiff. (*R. Swartziana?*, Pfeiff.). Branching, reaching a yard in length: joints green, lf-like, crenate-oblong or rhombic, 1-5 in. long, $\frac{1}{2}$ -2 in. broad: fls. yellow, about 5 lines long. Brazil.

15. *pachyptera*, Pfeiff. (*R. alata*, Steud.). Erect, branching, reaching a height of nearly 3 ft.: joints flat, rarely 3-winged, rather thick, usually somewhat

concavo-convex, 3-8 in. long, blunt, 2-5 in. broad, often purple-red: fls. about 8 lines long, yellow with reddish tips. Brazil. B.M. 2820 (as *Cactus alatus*).

16. *Houlletiana*, Lem. (*R. Houlletii*, Lem.). St. richly branched, becoming 3 ft. or more long, 1-1 $\frac{1}{2}$ in. broad, often tapering to the round midrib for a considerable distance, then becoming again broad and lf-like: fls. 8-9 lines long, yellowish white to yellow: berry red. Brazil. B.M. 6089.

R. angustissima, Web., *R. chloroptera*, Web., *R. Novaeii*, Löfgren, *R. Stimmeri*, Beauverd, and *R. Wiercklei*, Berger, are recent species occasionally seen in European collections, but not offered in American trade.

J. N. ROSE.

RHIZOPHORA (Greek, *root and bearing*, referring to the fact that the seeds germinate even while attached to the plant if they touch the ground). *Rhizophoraceae*. Trees, with thick terete scarred branches, sometimes planted to hold seashores: lvs. opposite, petioled, thick, leathery, ovate or elliptic, entire, glabrous: peduncles axillary, di- or trichotomously branched, few-fl.: fls. rather large, leathery, sessile or pedicelled; calyx-limb 4-parted; petals 4; stamens 8-12; ovary semi-inferior, 2-celled: fr. leathery, ovoid or obconical, 1-celled, 1-seeded.—About 3 species, seashores of the tropics. *R. Mangle*, Linn. Shrub or tree reaching a height of 30 ft.: lvs. 2-6 in. long, leathery, elliptic or elliptic-obovate, obtuse: peduncles 2-3-fl.: fls. pale yellow; sepals lanceolate; petals linear, or nearly so, leathery, cleft at tip. Coast of Fla. and the tropics. It forms impenetrable thickets.

RHODANTHE: *Helipterum*.

RHODAZALEA: a name given in France to a hybrid (*R. Croxii*, Hort.) between a garden rhododendron and *Azalea mollis* (*Rhododendron sinense*). Another name for this hybrid is *Azaleodendron Crouzii*, Hort.

RHODEA: *Rohdea*.

RHODOCHITON (Greek, *red cloak*; alluding to the large rosy red calyx). *Scrophulariaceae*. A free-flowering graceful vine with lvs. cordate, acuminate, sparsely and acutely dentate: fls. solitary, pendulous, axillary, long-peduncled; calyx conspicuous, large, membranous, broad bell-shaped, 5-cleft; corolla-tube cylindrical, the throat not personate, 5-lobed; lobes oblong, nearly equal: caps. dehiscent by irregular perforations.—One species, Mex.

volubile, Zucc. **PURPLE BELLS**. A vine with habit of maurandia, to which it is allied, but more vigorous and having curious, distinct purplish red fls. over 2 in. long on red peduncles: lvs. about 3 in. long. B.M. 3367. B.R. 1755. G.C. III. 53:310. G.M. 58:376. Gn.W. 12:449. I.H. 42:31. J.H. III. 43:563. R.H. 1910, p. 79.—Blossoms the first season from seed and may be treated as a tender annual.

F. W. BARCLAY.

RHODODÉNDRON (Greek, *rhodon* and *dendron*, rose-tree; the Rhododendron of the ancient writers is Nerium). *Ericaceae*. Including *Azalea* which most botanists consider inseparable from Rhododendron, but horticulturists may be inclined to retain *Azalea* for the deciduous species and to use the *Azalea* names given in parentheses. Highly ornamental woody plants, chiefly grown for their beautiful flowers and many species also for their handsome foliage.

Evergreen or deciduous shrubs, rarely trees: lvs. alternate, short-petioled, entire: fls. pedicelled, in terminal umbel-like racemes, rarely lateral, in 1- to few-fl. clusters; calyx 5-parted, often very small; corolla rotate, campanulate or funnel-shaped, sometimes tubular, with 5-, sometimes 6-10-lobed limb; stamens 5-10, sometimes more; anthers opening with pores at the apex; ovary 5-10-loculed; style slender with capitate stigma: caps. separating into 5-10 valves containing numerous

minute seeds.—About 350 species are known, distributed through the colder and temperate regions of the northern hemisphere; in Trop. Asia they occur in the mountains and extend as far south as New Guinea and Austral., the greatest segregation being in Cent. and W. China and the Himalayas; several species closely allied to those of the Malayan Archipelago are found in the Philippine Isls. but are not yet intro.; 16 species occur in N. Amer. The rhododendrons possess but few economic properties. The hardy close-grained



3378. A common hybrid form of garden rhododendron. (X $\frac{1}{4}$)

wood of the arborescent species is used for fuel; also for construction and for turnery work; the lvs. of some species are used medicinally; those of *R. arboreum* and other species are believed to be poisonous to cattle. In India the fls. of various species are sometimes made into a subacid jelly. The honey obtained from the fls. is believed to be poisonous.

The rhododendrons belong to our most ornamental and most beautiful flowering shrubs and are often completely covered with their showy trusses of brilliantly and variously colored flowers and the evergreen species are attractive throughout the whole year with their handsome usually large foliage. They grow best in a peaty or porous loamy soil, which does not contain lime and always retains a sufficient amount of moisture; they like as a rule half-shaded positions. In regard to their culture and particular ornamental qualities, they may be divided into three horticultural groups: Evergreen rhododendrons, hardy deciduous azaleas, and Indian azaleas.

Evergreen rhododendrons.

Here belong the largest number of species comprising the two sections *Lepidorrhodium* and *Leiorrhodium*. Although most of the species are hardy only in warm temperate regions, there are many which are hardy at least as far north as Massachusetts. They are *R. maximum*, *R. catawbiense*, *R. caucasicum*, *R. brachycarpum*, *R. Metternichii*, *R. Smirnovii*, *R. mucronulatum*, *R. dahuricum*, *R. micranthum*, *R. lapponicum*, *R. ferrugineum*, *R. hirsutum*, *R. Kotschyi*, *R. carolinianum*, *R. minus*, and probably also *R. chrysanthum*, *R. Przewalskii*, *R. campanulatum*, *R. californicum*, *R. Ungernii*, and most of the small-leaved Chinese species. Somewhat more tender are *R. ponticum*, *R. niveum*, *R. Hodgsonii*, *R. Thomsonii*, *R. Anthopogon* and many of the recently introduced Chinese species, as *R. discolor*, *R. oreodoxa*, *R. decorum*. South of Philadelphia such

species as *R. cinnabarinum*, *R. glaucum*, *R. ciliatum*, *R. Fortunei*, *R. lepidotum*, *R. Collettianum*, and the Yunnan species, as *R. yunnanense*, *R. irroratum*, and *R. racemosum*, are probably hardy; also *R. arboreum*, *R. barbatum*, *R. Falconeri*, *R. Keysii*, *R. triflorum*, and *R. Wrightii* in very sheltered positions. Species like *R. Dalhousiae*, *R. Edgeworthii*, *R. Griffithianum*, *R. formosum*, *R. Maddenii*, *R. Nuttallii*, and *R. pendulum* stand only a few degrees of frost. The Javanese species, as *R. javanicum*, *R. jasminiflorum*, *R. Brookeanum* and *R. Lobbianum* grow and bloom continually and stand no frost at all.

Variation in height.—Most of the species are shrubby; a few only, and these mostly Himalayan species, grow into small or medium-sized trees, attaining 60 feet in the case of *R. barbatum*, 40 feet in *R. grande* and *R. arboreum*, 30 feet in *R. Falconeri* and *R. maximum*. A number of northern and alpine species always remain dwarf, as *R. ferrugineum*, *R. hirsutum*, *R. lapponicum*, *R. virgatum*, *R. lepidotum*, *R. racemosum*, and others. A few Himalayan and Chinese species and most of the Malayan species are often epiphytal and grow on branches of large trees like orchids; e. g., *R. Dalhousiae*, *R. pendulum*, *R. Nuttallii*, *R. moupinense*.

Hybrid rhododendrons.—Many hybrids have been raised and they are now more extensively cultivated than the original species. The first hybrid was probably the one raised from *R. ponticum*, fertilized by a hardy azalea, probably *A. nudiflorum*; it originated about 1800, in the nursery of Thompson, at Mileend, near London, and was first described and figured as *R. ponticum* var. *deciduum* (Andrews, Bot. Rep. 6:379). Many hybrids of similar origin were afterward raised for which the name *Azalcodendron* has been proposed by Rodigas. The first hybrid between true rhododendrons was probably a cross between *R. catawbiense* and *R. ponticum*, but it seems not to have attracted much attention. It was by hybridizing the product of this cross with the Himalayan *R. arboreum* introduced about 1820 that the first plant was raised which became the forerunner of a countless number of beautiful hybrids. From the appearance of this cross, obtained about 1826, at Highclere, in England, and therefore called *R. altaclarensis*, the era of rhododendron hybrids is to be dated. Figs. 3378 and 3379 are common hybrid forms. A second era in the history of the rhododendron may be dated from the introduction of a large number of the beautiful Sikkim rhododendrons about 1850, among them species like *R. Griffithianum* which entered into the parentage of many of the most striking tender hybrids, and from the introduction of the Javanese species shortly afterward. A third era will perhaps be traced from the recent introduction of the Chinese rhododendrons.

Their place in ornamental planting.—Rhododendrons are equally effective and desirable as single specimens on the lawn as when massed in large groups, and are especially showy when backed by the dark green foliage of conifers, which at the same time afford a most advantageous shelter. The dwarf species, which are mostly small-leaved and flower at a different time, should not be grouped with the large-leaved ones, as they do not harmonize with them; however, they are exceedingly charming plants for rockeries or in groups with other smaller evergreens. It is certainly true that the rhododendrons have not yet received the attention they deserve. They are still far from being as popular as they are in England. The beautiful Himalayan species and their numerous hybrids are still almost unknown in this country, although without doubt they could be grown as well outdoors in the Middle and South Atlantic states as they are in England, if the right situation were chosen. Formerly it was considered impossible to grow the beautiful hardy hybrids in the New England

states, and it was first shown by the splendid collections of H. H. Hunnewell at Wellesley, Massachusetts (see A.F. 13:24-31 and Gng. 5:375-7), that, even in a trying climate, they can be grown to perfection if the proper situations are found and the right way of cultivation is followed.

Outdoor cultivation.—The selection of a suitable situation is of foremost importance. If possible the beds should be sheltered against drying winds and the burning sun by tall conifers, but the shelter should be always light and natural, as too much shelter by dense hedges or walls close to the plants is worse than no shelter at all. Any open well-drained soil which does not contain lime or heavy clay and has a moist and fresh subsoil will prove satisfactory. Where limestone or heavy clay prevails, beds must be specially prepared and filled with suitable soil. They should be at least 2 to 3 feet deep, or deeper when the subsoil is not porous, and in this case the bottom should be filled in about 1 to 2 feet high with gravel or broken stones for drainage. A mixture of leaf-mold or peat and sandy loam will make a suitable soil. In dry spells during the summer, watering is necessary if the subsoil is not very moist; it is most essential that the soil never becomes really dry. In autumn the ground should be covered with leaves, pine needles, hay, or other material to protect from frost. This mulch should be allowed to remain during the summer, especially when the plants are not large enough to shade the ground. An occasional top-dressing of well-decayed stable- or cow-manure will prove of much advantage. The ground should never be disturbed, as the roots are very near the surface. After flowering, the young seed-vessels should be removed. The rhododendrons are easily transplanted either in spring or in fall, especially if they grow in peat or turfy loam, and if a good ball of earth can be preserved in moving. They should be planted firmly, especially in porous, peaty soil, and thoroughly watered after planting. If they are carefully handled they are not much affected by transplanting, and tender kinds may be dug in fall, heeled-in in a frost-proof pit, and planted out

caucasicum and with some infusion of *R. arboreum* and perhaps a few other species. As in most of them the parentage of *R. catawbiense* is the most predominant, they are all usually called "catawbiense hybrids." Choice kinds are (those marked with an asterisk have proved the hardest): *Album elegans*, blush, changing to white; *Album grandiflorum*, blush, changing to white, flowers larger, less spotted; *Alexander Dancer*, bright rose, paler in center; *Atrosanguineum*, rich blood-red; *August Van Geert*, bright carmine, spotted dark purple; *Bacchus*, crimson, large flowers; *Bicolor*, purplish pink, spotted; *Blandianum*, rosy crimson (H.F. 1859:153); **Bluebell*, blush, with light purplish margin; **Boule de Neige*, white, early; **Caractacus*, deep crimson; *Charles Bagley*, cherry-red; **Charles Dickens*, dark red, spotted brown, one of the most striking red ones; *Cerulescens*, pale lilac; **Coriaceum*, white, spotted yellow, dwarf and free-blooming; *Crown Prince*, carmine, spotted greenish yellow; **Delicatissimum*, blush, edged pink, changing to almost white, late (Gn. 63, p. 415); *Edward S. Rand*, rich scarlet; **Everestianum*, rosy lilac with crisped edges, excellent habit and very free-flowering (G. 26:103); **F. L. Ames*, white center, edged pink; **F. L. Olmsted*, pink; **Giganteum*, bright rose, large clusters; **Glennyanum*, white, suffused with pink (G.M. 44:355; 48:565); **Gomer Waterer*, blush-pink; *Grandiflorum*, clear rose; *Guido*, deep crimson; *Hannibal*, rosy carmine; **Henrietta Sargent*, pink; *Henry W. Sargent*, crimson, large clusters; *H. H. Hunnewell*, rich crimson; *John Waterer*, dark crimson; *J. D. Godman*, carmine, distinctly spotted; **Kettledrum*, rich crimson; **King of Purples*, purple, spotted dark brown; *Lady Armstrong*, rose-red, paler in center, distinctly spotted; **Lady Clermont*, rosy scarlet; **Lady Frances Crossley*, salmon-pink; *Lady Gray Egerton*, delicate lilac, spotted greenish brown; **Lee's Purple*, purple; *Madam Carvalho*, blush, changing to pure white; **Melton*, rich purple; **Mrs. C. S. Sargent*, similar to *Everestianum*, but pink; *Mrs. Milner*, rich crimson; **Norma*, pink; **Old Port*, plum-color; *Princess Mary of Cambridge*, white with purple margin; **Purpureum crispum*, lilac-purple, spotted greenish; **Purpureum grandiflorum*, purple, large clusters; *R. S. Field*, scarlet; *Ralph Sanders*, rich purplish crimson; *Rosa mundi*, white slightly flushed with yellow spots, dwarf (Gn. 63, p. 369); *Roseum elegans*, rosy lilac, dwarf; *Scipio*, rose with deep spot; **Sefton*, deep maroon, large clusters; *Wellsianum*, blush, changing to white.

For greenhouse culture, the most successful way, especially with the taller-growing species, like *R. arboreum*, *R. Griffithianum*, *R. barbatum*, and *R. Falconeri*, is to plant them out in a porous peaty soil provided with good drainage. If grown in pots, a sandy compost of leaf-soil and peat, with an addition of some fibrous loam, will suit them. The pots, which should never be too large, must be well drained and the plants freely watered during the summer, while during the winter water must be carefully applied. The Himalayan species and their hybrids will do well in a cool greenhouse, where the temperature is kept a few degrees above freezing-point during the winter. The Javanese species and hybrids, however, on account of their continual growing and blooming, require a warmer greenhouse and must have a minimum temperature of 50° during the winter. They like a moist atmosphere and should be freely syringed in warm weather. In potting them, their epiphytall habit must be borne in mind, and the soil should consist mainly of good fibrous peat broken into pieces, with a liberal addition of sand and broken charcoal. The soil should never be allowed to become dry. They are readily propagated by cuttings with bottom heat in the warm propagating-house. The Javanese rhododendrons are especially valuable for their continual blooming during the winter and the brilliant color of their flowers. A large number of beautiful hybrids have been raised; the following are a



3379. A good plant of garden rhododendron in bloom.

again in spring. Potted and well-budded plants transferred in January into a temperature not exceeding 60° will develop in about six to eight weeks into very attractive and showy specimens for decoration.

Hardy varieties.—The following varieties have proved in the vicinity of Boston and may be recommended for planting in similar climates and for experimental trial farther north. They are mostly hybrids of *R. catawbiense* with *R. maximum*, *R. ponticum*, *R.*

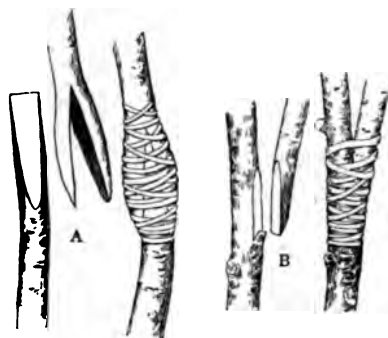
small selection of them: *Balsaminiflorum*, with double pink flowers (Gt. 37, p. 265. G.C. II. 18:230; III. 12:769. J.H. III. 43:151. G.Z. 27:241); *Balsaminiflorum album*, with double white flowers (Gn.W. 5:373); *Balsaminiflorum aureum*, with double yellow flowers; *Brilliant*, brilliant scarlet; *Ceres*, tawny yellow (Gn. 41:845); *Diadem*, orange-scarlet; *Duchess of Connaught*, vermilion-red; *Duchess of Edinburgh*, scarlet with orange-crimson (F.M. 1874:115); *Eos*, scarlet-carmine (G.C. III. 19:327); *Exquisite*, large light fawn-yellow flowers (Gn. 56:62); *Favorite*, satiny rose; *Jasminiflorum carminatum*, deep carmine (Gn. 41:328); *Little Beauty*, flowers small, but bright carmine-scarlet (Gn. 56:242); *Lord Wolseley*, bright orange-yellow, tinted with rose at the margins; *Luteo-roseum*, flowers satiny rose, suffused with white, center light yellow (G. 33:313); *Maiden's Blush*, blush, with yellowish eye (Gn. 16:394); *Princess Alexandra*, white, faintly blushed; *Princess Frederica*, yellow, faintly edged rose; *Princess Royal*, pink; *Rosy Morn*, bright pink (Gn. 42:164); *Taylori*, bright pink, with white tube (F. M. 1877:242); *Triumphans*, crimson-scarlet.

Propagation.—All rhododendrons are easily propagated by seeds, which are very small and are sown in spring in pans or boxes well drained and filled with sandy peat. Pots should be well watered previous to sowing. The seeds should be covered only a very little with fine sand or finely cut sphagnum, or merely pressed in and not covered at all. To prevent drying, a glass plate may be placed over the pan or some moss spread over the surface; this, however, must be taken off as soon as the seeds begin to germinate. The seeds also germinate very readily if sown on fresh sphagnum, but in this case they must be pricked off as soon as they can be handled. In any case, it is of advantage to prick off the young seedlings as soon as possible, but if they are not sown too thickly they may remain in the seed-boxes until the following spring. The seedlings of hardy rhododendrons should be placed in coolframes and gradually hardened off; those of greenhouse species remain under glass. Rhododendrons are also sometimes increased under glass by cuttings of half-ripe wood taken with a heel, and if gentle bottom heat can be given after callusing it will be of advantage. They root, however, but slowly, except those of the Javanese kinds, which are mostly propagated in this way, since they grow very readily from cuttings. Layering is sometimes practised, especially with the dwarf and small-leaved species, but the layers usually cannot be separated until the second year. For the propagation of the numerous varieties and hybrids of hardy and half-hardy rhododendrons grafting is most extensively employed. *R. catawbiense* or seedlings of any of its hardy hybrids may be used as stock; *R. maximum* is also probably as good. In English and Belgian nurseries *R. ponticum*, which is inferior in hardiness, is mostly employed as a stock, but this often proves fatal if the grafted plants are transferred to colder climates. *R. arboreum* may be used for strong-growing varieties intended for cultivation in the greenhouse or South. Veneer- or side-grafting is mostly practised, and sometimes cleft- and saddle-grafting (see G.C. III. 24:425 and Figs. 3380, 3381). The leaves should be removed only partly and the stock not headed back until the following year. The grafting is usually done late in summer or early in spring in the greenhouse on potted stock without using grafting-wax, and the grafted plants kept close and shaded until the union has been completed. If large quantities are to be handled the plants are sometimes not potted, but taken with a sufficient ball of earth, packed close together and covered with moss. Covering with moss to keep the atmosphere moist is also of much advantage if the plants are potted.

Other experience with the evergreen rhododendrons. (B. M. Watson.)—Rhododendrons, in this article, mean more particularly *R. maximum* and the hybrid varie-

ties of *R. catawbiense*; in the main, however, the directions for the various operations apply to the azalea group and to many other members of the heath family.

Rhododendrons as a class are increased by seeds, layers and grafts, and occasionally by cuttings. Seeds should be sown under glass, between January 1 and March 15, in soil one-half peat and one-half pure fine sand, with good drainage. The seeds are small and



3380. Grafting of rhododendron. Saddle-graft at A; veneer-graft at B.

require no covering, the usual watering after sowing being quite sufficient. A thin layer of sphagnum over the surface of the seed-pan is good protection from the sun and keeps the soil evenly moist; it should be removed when germination begins. Seeds may also be sown on growing sphagnum, a thin layer being compactly spread above the seed-soil and drainage, and an even surface being secured by clipping. Seed-pans or flats of convenient size are used and they should be plunged in sphagnum still further to insure even moisture; the temperature of the house should be 45° to 50° F. Seedlings are prone to damp-off and should be pricked off into fresh soil as soon as they are big enough to handle; wooden pincers, made from a barrel hoop, are handy for this work. They are slow growers, and must be tended carefully. Keep under glass, well shaded until the weather is settled. Frames with lath screens make good summer quarters. Winter in pits and plant out in frames in peaty soil when large enough. Never let them suffer from dryness. It has been suggested that the seed of *R. maximum* might be planted on living moss under high-branched trees in swamps where the water does not collect in winter. (See Jackson Dawson, on the "Propagation of Trees and Shrubs from Seeds," in Transactions of the Massachusetts Horticultural Society, 1885, part I, page 145.) Layers probably make the best plants, and in the best English nurseries layering is the common method of propagation. In the United States layering in spring is preferable, but abroad it is practised in both spring and autumn. It is a slow process, but desirable for the hardy hybrids of *R. catawbiense*. Roots form on wood of almost any age; when removed the layers should be treated as rooted cuttings and carefully grown in well-prepared soil where water and shade are easily furnished. See **Layering**. See, also, G.F. 6:63 (1893) for an interesting account of layering large plants by burying them to the top.—Grafting is the common method of propagation, and is employed almost universally in continental nurseries. *R. ponticum* is the usual stock, a free grower and readily obtained from seeds. Attempts have been made to use *R. maximum* in American nurseries, because of the tenderness of *R. ponticum*, but no great progress has been made. It is asserted that the rate of growth is somewhat slower than that of the hybrids; this seems hardly possible, and it is to be hoped that further experiments will be made. *R. maximum* should

be established in pots in spring and grafted under glass in autumn and early winter, using the veneer-graft (see *Grafting*, page 1362, Vol. III). Graft as near the root as possible and plant the worked parts below the surface when planting in the nursery or permanently. With these precautions, and an extra covering of leaves until the plant is established on its own roots, the defect of tenderness in this stock can be overcome. Nurse carefully the young grafted plants in frames until of sufficient size to be planted in the nursery rows. Figs. 3380 and 3381 illustrate two common methods of grafting rhododendrons and other woody plants. The details of the unions are shown in Fig. 3380, and the completed work in Fig. 3381. Statements are made that cuttings of half-ripened wood will strike, but it is not likely that this will ever prove a practical method of propagating *R. maximum* or the *R. catawbiense* hybrids; it might be worth while to experiment with wood grown under glass,

of humus. To nearly pure peat an admixture of sand is beneficial; the essential point is that all soils for these plants must be fine. The beds should be prepared in autumn and left to settle all winter, due allowance being made for shrinking. In spring level off to the grade of the adjacent land and do not leave "rounded up." A bed higher at the center than at the sides perhaps makes a better display of the plants, but is more likely to dry up and does not catch all the water possible from occasional showers. It is generally conceded that lime soils and manures containing lime, e.g., wood-ashes and bone-meal, are injurious to rhododendrons; in limestone regions it is undoubtedly advisable to substitute, for the natural soil, others which are free from this objectionable element.

Plant rhododendrons in spring when weather is settled and the March winds have passed. If the ball of roots is dry, soak well before setting. Plant closely, so that the tops are only 10 to 12 inches apart and pay particular attention to "facing" them, i. e., see that the best side is facing the most important point of view, and that all are faced alike. Grafted plants should, if possible, have the worked portion below the surface. Do not plant in autumn. Plants grown on the premises may be transplanted in favorable weather in summer if great care is taken to prevent the roots suffering from dryness. In planning the original border it is well to leave room for extension: when planted, as described above, the beds can be enlarged at intervals of four or five years, or new beds made from the old stock. Place the beds so that the glare of the midday sun is screened both summer and winter, and avoid situations where there is any interference, owing to trees or buildings, with a naturally good condition of the soil in respect to moisture. If permanent protection is desired, use conifers, particularly the hemlock, in preference to deciduous trees. Good positions for beds may be found along



3381. Saddle-graft at A; veneer-graft at B. (For comparison with Fig. 3380.)

particularly with some of the smaller-leaved evergreen kinds.

As to cultivation, the point on which successful American growers of rhododendrons now insist is that the water-supply shall be sufficient. (See H. H. Hunnewell, in G.F. 3:201, 1890.) To effect this: (1) make the soil deep and fine, using materials like peat, leaf-mold, well-rotted manure and yellow loam, all of which are retentive of moisture; (2) plant in masses, at any rate while young, so that they may protect each other and prevent evaporation; (3) give the bed a northern exposure or a situation where the force of the midday sun is broken; (4) do not plant under or near trees like elm, oak, or maple, which make undue inroads on the natural water-supply, nor so near buildings that the border is sheltered from rain or overdrained by cellar walls; (5) mulch with leaves summer and winter, protect from wind and sun with evergreen boughs in winter and in summer give heavy watering whenever the weather is excessively hot or dry.

The planting-bed should be prepared by excavating to the desired dimensions and at least 3 feet deep. The poor material should be discarded, but the good soil can be replaced, adding enough peat and the like (see above) to make good that which was rejected; all should be thoroughly and carefully mixed. Peat, although excellent, is not necessary. Yellow loam or hazel loam, if not too sandy, is equally good and is improved by additions

the edges of ponds and streams, and in reclaimed meadows, with their cool moist soil, but keep aloof from any ground where the water collects in summer or winter. Beds, or even single plants, if sizable, may be introduced into open spaces in woodlands if the precautions noted above are observed and plenty of air and light are obtainable. It is somewhat difficult to combine rhododendrons and many deciduous shrubs, among which are the azaleas, their near relatives. A background of dark green conifers seems most appropriate. Mountain laurels, *Pieris floribunda*, *Leucothoe catesbaei*, and *Daphne cneorum* are proper companions, but at times these seem better apart. Our native lilies, *L. superbum* and *L. canadense*, are good associates and thrive under the same conditions. In hot, dry weather water should be given, not daily in dribbles, as lawns are sprinkled, but in quantity, enough at one time to soak the border to the depth of the soil, but at comparatively infrequent intervals, once a week or so. The bed should also be mulched with leaves, or other material, to prevent evaporation; grass clippings are serviceable, but should not be used in large quantities at any one time or else they will heat. Leaves make good winter protection, which should be given just before cold weather,—in eastern Massachusetts, between Thanksgiving and Christmas. Let the bed be covered to the depth of 10 to 12 inches, well worked in beneath the foliage but not over it. In spring dig as much as pos-

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XCVI. Rhododendron well placed.—One of the *Rhododendron catawbiense* varieties.

sible of this material into the ground, reserving a part for the summer mulch. Shelter the tops with evergreen boughs, the butts driven into the earth a foot or more; in windy positions a temporary board fence is useful.

Experience at Rochester, New York (John Dunbar).—About fourteen years ago, rhododendrons were planted in the Rochester City Parks in beds excavated to a depth of 2 to 2½ feet (sandy soil containing lime removed), and filled with humus or soil of a peaty nature from an adjacent swamp. Cow-manure was mixed liberally in the surface. Rhododendrons planted in this preparation began to root immediately, grew with vigor, and flowered splendidly. About 20,000 square feet have been planted to rhododendrons in this way with unflinching success. A ¾-inch-pipe water-system is connected with all of the beds, with faucets at convenient points, and the plants are thoroughly watered in the growing season, and are never permitted to enter the winter with dry roots. The natural drainage is perfect. Rhododendrons will not tolerate stagnant moisture at their roots. They are thoroughly protected by the lay of the land from the west, northwest, and north winds, but are completely exposed to the south, summer and winter, and with the exception of a heavy mulching of leaves, spread over the beds in the autumn, they receive no other protection. The lace-fly became a very serious pest some years ago. The colonies of nymphs feed on the under side of the leaves and the foliage presents a sickly yellow appearance, as if attacked by red-spider. This is promptly destroyed and kept under control by two sprayings of Ivory soap during the growing season, using it in the proportion of five bars of soap to one hundred gallons of water.

The following are hardy at Rochester in a normal winter: *Catawbiense*, *Catawbiense album*, Anna Parsons, *Album elegans*, *Album grandiflorum*, Alexander Dancer, *Amarantinora*, *Atrosanguinea*, Bertha Parsons, *Boule de Neige*, *Caradacus*, Charles Dickens, *Cerulea*, Daisy Rand, *Delicatissimum*, Dr. Torrey, Edward S. Rand, *Everestianum*, F. D. Godman, F. L. Ames, *Flushing*, General Grant, *Glennyanum*, Guido, *Henrietta Sargent*, Henry Probasco, H. W. Sargent, *Ignatius Sargent*, J. R. Trumpy, *Kisena*, *Kettledrum*, Lady Armstrong, *Macranthum*, *Maximum*, *Maximum superbum*, *Maximum Wellmanum*, Mrs. C. S. Sargent, Mrs. Harry Ingersoll, Mrs. Henry S. Hunnewell, Mrs. Milner, Old Fort, *President Lincoln*, *President Roosevelt*, *Roseum pictum*, *Roseum elegans*, Samuel B. Parsons, *Scipio*, Senator Charles Sumner, *Sherwoodianum*.

The following are liable to severe injury in a very cold winter: *Blandjanum*, *Beauty of Surrey*, Charles S. Sargent, Charles Bagelay, *Giganteum*, *Hannibal*, H. H. Hunnewell, James Bateman, James MacInosh, J. Marshall Brooks, John Waterer, Lady Clermont, Lady Gray Egerton, Madame Carnalho, Meteor, *Marchioness of Londondowne*, Mrs. John Clutton, Ralph Saunders, *Rosabel*, *Stella*, *The Queen*.

The following species and hybrids are hardy: *R. arbutifolium*, *campanulatum*, *caucasicum pictum*, *carolinianum*, *dahuricum*, *ferrugineum*, *hirsutum*, *Melternichii*, *mucronulatum*, *myrtifolium*, *Smirnovii*.

Hardy deciduous azaleas.

These include the species of the sections *Pentathera* and *Rhodora* and some of the section *Tsutsutsi*, and the hybrids known as Ghent azaleas. Most of them are hardy, but in the North and in exposed situations a protection with brush, hay, or mats should be given in winter, to protect the flower buds from sudden changes of temperature.

In the open, the flowering period of hardy azaleas extends from April to July. First comes *R. canadense*, *R. rhombicum*, and *R. Vaseyi*; then *R. nudiflorum* and *R. japonicum*, followed by *R. luteum* and *R. calendulaceum* and nearly at the same time, *R. Schlippenbachii* and *R. Albrechtii*; somewhat later, *R. occidentale*, and last, *R. arborescens* and *R. viscosum*. One of the most beautiful is the American *R. calendulaceum*, which is hardly surpassed in the brilliancy and abundance of its flowers by any of the Ghent hybrids. There may also be mentioned the few species of true rhododendrons with deciduous foliage, as *R. mucronulatum* and *R. dahuricum*, which are the very earliest to bloom, and the hardy deciduous Indian azaleas, as *R. poukhanense* and *R. Kaempferi*, which flower with *R. Vaseyi* and *R. nudiflorum*. Azaleas are easy to transplant, either in

early spring or in early autumn, when the year's growth has ripened. If desired, they may be planted for decorative purposes in early spring, in beds, without injuring the abundance or brilliancy of the flower, and afterward removed to give space for other decorative plants, and planted carefully in nursery beds, where they remain till next spring; and so on every year. Especially the hybrids and varieties of *R. japonicum* (*Azalea mollis*) are often and easily forced for winter-flowering. If intended for early forcing, they should be grown in pots, and care taken to allow them to finish their growth as early as possible; for later forcing, after Christmas, they may be potted in fall, or even just before bringing them into the forcing-house. With a temperature of 50° to 55° at night, they will bloom in about six weeks. The Ghent azaleas are grown in great quantities in the Low Countries and in Germany for export to America; it is usually more profitable to buy this stock each fall than to attempt to raise it in this country, where labor is high-priced and the climate dry and hot.

Propagation is usually by seeds sown in early spring in frames or pans, in sandy peat, without covering, and kept moist and shady. When the seedlings appear they should have air and a daily syringing. In autumn they are transplanted into boxes or frames, in sandy, peaty soil. The seeds germinate very readily sown in cut sphagnum, but ought to be pricked into boxes as soon as they can be handled. The second year the seedlings should be planted out in beds, sufficiently wide apart to allow a growth of two years. Long upright branches should be shortened, to secure well-branched plants. The named varieties are grafted on any of the common species, usually by veneer-grafting in autumn in the greenhouse, on potted stock. They may also be increased by cuttings of mature wood 2 to 3 inches long, taken with a heel late in summer, and placed in sand under glass. Layers usually require two years to root sufficiently; they are made in spring, and the buried part inclosed in moss.

Many hybrids, known as Ghent azaleas or *Mollis* hybrids (*R. Morteri*, Sweet, *Azalea Mortieriana*, Spae, *A. gandavensis*), are in cultivation. They have originated chiefly from crosses of *R. sinense*, and later *R. japonicum*, with *R. luteum*, *R. calendulaceum* and *R. nudiflorum*, also in some cases with *R. occidentale* and *R. viscosum*. Some good varieties are the following:

Single-flowered varieties: *Albicans*, *Admiral de Ruyter*, *Attaclarense* (B.R. 28:27); *Anthony Koster*, *Comte de Gomer* (R.B. 1:9. F.M. 1879:367); *Daviesi* (Gt. 42:1307); *Directeur Charles Baumann*, *Fragrans* (J.H. III:49:489); *Géant des Batailles*, *Hilda*, *Louis Hellebruyck* (F.S. 19:2019); *Marie Verschaffelt*, *Morteri*, *Princesse d'Orange*, *Sanguinea*, *Tsarine* (R.B. 20:277); *Van Dyck*, *Viscosa floribunda*.

Double-flowered varieties: *Arethusa*, *Bijou de Gandbrugge* (F.S. 19:2024); *Louis Aimé Van Houltte* (F.S. 19:2022); *Madame Mina Van Houltte* (F.S. 19:2021); *Murillo* (R.B. 19:232); *Phebe* (R.B. 19:232); *Raphael de Smet*, *Virgile* (R.B. 19:232. G.W. 15, p. 493).

Indian azaleas.

This group contains *R. indicum* and other species of the section *Tsutsutsi* and the hybrids of them. They are well-known evergreen shrubs, in the North requiring cultivation in the greenhouse during the winter, but some, as *R. Kaempferi* and *R. poukhanense*, have proved perfectly hardy in the neighborhood of Boston; also *R. ledifolium* and *R. linearifolium* will stand many degrees of frost in somewhat sheltered positions. Indian azaleas are rarely increased by seeds, which may be sown in the greenhouse in the same way as with the former group. Usually they are propagated by cuttings or grafting. The cuttings root best when made in August from half-ripened wood, and placed in sand under a frame, with gentle bottom heat. Choicer varie-

ties are usually increased by veneer- or tongue-grafting, either in winter or in July and August on vigorous-growing varieties raised mostly from cuttings. Grafting on rhododendron is now used in some German nurseries with very good results. The best soil for azaleas, if grown in pots, is a sandy compost of half peat and half leaf-soil, with an addition of good fibrous loam. It is essential to plant them firmly, and to give very good drainage. The base of the stem should be just above the surface. The best time for repotting is after flowering, when the new growth commences. During the summer, they should be kept in a coldframe or in the open in a sheltered spot, with the pots plunged in the soil, or planted out in prepared beds, where they make a very vigorous and healthy growth. In September they should be repotted and transferred to the greenhouse. They must have plenty of water and free syringing during the hot months. The natural flowering time is from April to June, but in the greenhouse, azaleas may be had in flower from November till June. Against the red-spider and thrips, from which the azaleas are liable to suffer if the air is too dry, free syringing with water is the best remedy. Most of the plants used for forcing in this country are imported from Holland, Belgium, and Germany. Formerly azaleas were kept in summer in shade or partial shade, but now it is the custom of the best growers to give them full exposure to the sun, either planted out or in the pots plunged to the rim in ashes or other good drainage material; in the latter case a top-dressing of 2 or 3 inches of old cow-manure is very beneficial. The only American treatise is Halliday's "Treatise on the Propagation and Cultivation of *Asalea Indica*," Baltimore, 1880.

Some of the best varieties of Indian azaleas are the following (for a completer account, see August Van Geert, "Iconographie des Azalées," abbreviated here as *ic. Az.* 20):

Single-flowered: *Antigone*, white, striped and spotted violet (R.B. 7:241. *ic. Az.* 3); *Apollo*, vermillion (*ic. Az.* 20); *Charmer*, rich amaranth, very large (F.M. 5:303, 304, 1); *Comtesse de Beaufort*, rich rose, blotched deep crimson; *Criterion*, rich salmon-pink, bordered white and blotched crimson (F.S. 8:796. F. 1849:137); *Diamond*, white, blotched dark crimson (F.S. 21:2233, 2234); *Duc de Nassau*, rich rosy purple, very free and large; *Easter Greetings*, small, flower often semi-double, crimson, very free-flowering; *Eclatante*, deep crimson, shaded rose; *Emil Liebig*, pink; *Fanny Ivery*, deep salmon-scarlet, blotched magenta (F.M. 10:542); *Fiedler's White*, pure white, early (A.F. 13:1169); *Flambeau*, rich, glowing crimson (Gn. 16:242, 4); *Fuerstin Bariatinsky*, white, striped red (Gn. 16:242. *ic. Az.* 13); *Haerens' Lorraine*, small bright pink flowers, very floriferous; *Heze* (Firefly), deep crimson, "hose in hose," small fl. very free-flowering (R.B. 31:49); *Jean Vervæne*, salmon, striped, bordered white (R.B. 2:145. *ic. Az.* 11); *John Gould Veitch*, lilac-rose, bordered and netted white, striped crimson (F.S. 20:2071, 2072); *La Victoire*, reddish, white toward the edges, spotted maroon-crimson; *Louise von Baden*, pure white, sometimes speckled pink (F.S. 17:1796. F.M. 3:158); *Madame Charles Van Eeckhaute*, pure white, with crisped edges; *Madame L. Van Houtte*, scarlet-rose, bordered white (F.S. 23:2383. *ic. Az.* 5); *Marquis of Lorne*, brilliant scarlet, very fine; *Miss E. Jarret*, pure white, with crisped edges (R.B. 14:213); *Mrs. Turner*, bright pink, bordered white, spotted crimson (F.S. 8:451. Gn. 56, p. 306); *Mons. Thibaut*, orange-red; *Perle de la Belgique*, large, pure white; *President Victor Van den Hecke*, white, striped and speckled crimson, with yellow center (F.S. 15:1567, 1568); *Princess Alice*, pure white, one of the best; *Princesse Clementine*, white, spotted greenish yellow; *Professor Wollers*, pink, with amaranth blotch; *Reine des Pays-Bas*, rich violet-pink, bordered white (I.H. 13:479); *Roi de Hollande*, dark

blood-red, spotted black; *Sigismund Rucker*, rich rose, bordered white, blotched crimson, very showy (F.S. 19:2010, 2011. *ic. Az.* 31); *Stella*, orange-scarlet, tinged violet; *Wilson Saunders*, pure white, striped and blotched vivid red.

Double-flowered: *Alice*, deep rose, blotched vermillion (I.H. 23:244); *Baron N. de Rothschild*, rich purple-violet, large (F.S. 23:2477, 2478); *Bernard André*, dark violet-purple, large; *Bernard André alba*, white (I.H. 17:15. *ic. Az.* 19); *Borsig*, pure white; *Charles Leirens*, dark salmon, blotched dark purple, good form and substance (F.S. 19:1971, 1972); *Charles Pynaert*, salmon, bordered white (R.B. 10:25); *Chicago*, deep carmine, bordered white, large; *Comtesse Eugénie de Kerchove*, white, flaked red-carmine; *Deutsche Perle*, pure white, early (R.B. 21:85. R.H. 1886:516. Gn. 33:460. *ic. Az.* 25); *Dominique Vervæne*, bright orange;



3382. *Rhododendron mucronulatum*. (×¼)

Dr. Moore, deep rose, shaded white and violet, very fine (R. B. 11:61); *Eggebrechtii*, bright crimson; *Empereur du Brésil* (Emperor of Brazil), rich rose, banded white, upper petals marked red (*ic. Az.* 15); *Ernest Eeckhaute*, deep carmine, very double; *Francois de Vos*, deep crimson (I.H. 14:512. *ic. Az.* 14. F.M. 8:443); *Frau Herm. Seidel*, white, striped red; *Helene Thelemann*, rosy pink, free-flowering; *Imbricata*, white, sometimes flaked rose (I.H. 24:281. F.S. 22:2284, 2285. F. 1876, p. 201); *Impératrice des Indes* (Empress of India), salmon-rose, bordered white and spotted dark carmine (F.M. 18:357. *ic. Az.* 21. F. 1879:97); *Johanna Gottschalk*, white; *John Liewelyn*, soft pink; *Louise Pynaert*, white (R.B. 4:209); *Madame Camille van Langenhove*, white, striped with rose, very double; *Madame Iris Lefebvre*, dark orange-carmine, shaded bright violet and blotched brownish red (F.S. 18:1862, 1863); *Madame Jos. Vervæne*, large, pink and white, similar to *Vervæneana*; *Madame Petrick*, bright rose, very early; *Madame Van der Cruyssen*, pink, fine form (A.F. 12:1003); *Madeleine*, white, large, semi-double; *Niobe*, white, fine form; *Pharilde Mathilde*, white, spotted cherry-red (R.B. 13:145); *President Ghellinck de Walle*, bright rose, upper petals spotted yellow and striped crimson; *President Oswald de Kerchove*, pink, bordered white, blotched carmine; *Raphael*, white; *Sakuntala*, white, very free-flowering; *Simon Mardner*,

large, rose, very double and very early; *Sou. du Prince Albert*, rich rose-peach, broadly margined white, very free-flowering (F.M. 4:201. Ic. Az. 24); *Theodore Reimers*, lilac, large; *Vervaneana*, rose, bordered white, sometimes striped salmon (Gn. 52, p. 137. C.L.A. 5:146; 7:179. J.H. 31:423); *Vervaneana alba*, white (R.H. 1908:424); *Vuystekeana*, deep crimson, "hose-in-hose."

The varieties now chiefly imported and considered the best for forcing are the following (those marked with an asterisk are adapted for early forcing):

Single-flowered: **Emil Liebig*, *Haerens* Lorraine, **Hexe*, Professor Wolters.

Double-flowered: **Eggebrectii*, *Empereur du Brésil*, *Ernest Eeckhaute*, **Frau Herm. Seidel*, **Helene Thelemann*, **Imperatrice des Indes*, *John Liewelyn*, **Madame Camille Van Langenhove*, *Madame Jos. Vervane*, **Madame Petrick*, *Madame Van der Cruyssen*, *Niobe*, *Pharalde Mathilde*, **Pres. Oswald de Kerchhove*, **Simon Mardner*, **Vervaneana*.

Plants grown in Germany are preferred for early forcing, because they are grown in pots over summer before shipping, while the Belgian plants are grown in the open field. Generally the Belgian plants are grown more compact, while the German-grown plants are of looser, more naturally graceful habit. Some varieties, though much approved abroad, are rarely imported, because they do not travel well.

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KEY TO THE GROUPS.

- A. Foliage evergreen, glabrous, lepidote or tomentose, rarely deciduous and lepidote, not ciliate or ciliate and lepidote: stamens 5-20; ovary glabrous, lepidote or tomentose, not setose, sometimes more than 5-celled. Subgenus I. EURHODODENDRON
- B. Lvs. lepidote: ovary lepidote; stamens 5-10.
- Section 1. LEPIDORHODIUM. Species Nos. 1-16
- BB. Lvs. glabrous or tomentose beneath, never lepidote, always persistent: ovary glabrous, glandular or tomentose; stamens 10-20.
- Section 2. LEIORHODIUM. Species Nos. 17-28

AA. Foliage deciduous, rarely evergreen, pubescent, often strigose and ciliate, rarely glabrous, never lepidote: stamens 5-10; ovary setose, rarely glabrous, 5-celled.

Subgenus II. AZALEA

B. Fls. from axillary buds, usually solitary; corolla rotate. Section 3. AZALEASTRUM. Species No. 29

BB. Fls. from terminal buds, 1 to many.

C. Terminal bud producing only fls., usually many-fl.: lvs. deciduous.

D. Stamens 5; corolla funnelform-campanulate or funnelform.

Section 4. PENTANTHERA. Species Nos. 30-38

DD. Stamens 7-10; corolla rotate-campanulate, deeply divided.

Section 5. RHODORA. Species Nos. 39, 40

CC. Terminal bud producing fls. and leafy shoots, 1-3-fl.; stamens 5-10: lvs. persistent or deciduous.

Section 6. TSUTSUTSI. Species Nos. 41-48

Subgenus I. EURHODODENDRON.

Section 1. LEPIDORHODIUM.

A. Corolla funnelform or campanulate; tube shorter or not much longer than lobes.

B. Fls. from a terminal bud, usually many.

C. Diam. of fls. $\frac{1}{4}$ - $\frac{3}{4}$ in.

D. Stamens and style longer than corolla, filaments glabrous; fls. white, small, in a many-fl. dense head.

1. *micranthum*

DD. Stamens and style shorter than corolla, filaments hairy below the middle; fls. usually pink; tube pubescent inside.

E. Style scarcely twice as long as ovary: lvs. $\frac{1}{2}$ -2 in. long.

F. Lvs. without hairs.

2. *ferrugineum*

FF. Lvs. ciliate.

3. *hirsutum*

EE. Style at least 3 times as long as ovary: lvs. 1-3 in. long.

F. Shape of lvs. lanceolate-elliptic.

4. *arbutifolium*

FF. Shape of lvs. elliptic.

5. *myrtifolium*

CC. Diam. of fls. 1-2 in.; tube glabrous inside.

D. Style and stamens shorter than corolla-lobes: petioles about $\frac{1}{2}$ in. long.

E. Tube of corolla longer than lobes, corolla lepidote outside, spotted.

6. *minus*

EE. Tube of corolla shorter or as long as lobes; corolla glabrous outside, usually not spotted.

7. *carolinianum*

DD. Style exceeding the corolla-lobes: petioles about $\frac{1}{2}$ in. long.

E. Color of fls. yellow: lvs. glabrous.

8. *Keiskei*

EE. Color of fls. pink, rarely white.

F. Lvs. ciliate or hairy on the midrib beneath: stamens longer than the corolla-lobes.

G. Midrib of lvs. pilose beneath; lvs. glabrous above: fls. rose-pink to purple.

9. *Augustini*

GG. Midrib of lvs. glabrous; lvs. setose above and ciliate, sometimes nearly glabrous: corolla white, spotted red.

10. *yunnanense*

FF. Lvs. never hairy: stamens somewhat shorter than corolla-lobes.

11. *yanthinum*

BB. Fls. from lateral buds usually crowded at the end of the branches, one or few from each bud.

C. Under side of lvs. glaucous and lepidote: fls. about $\frac{1}{4}$ in. across.

12. *racemosum*

CC. Under side of lvs. green and lepidote: fls. 1-1 $\frac{1}{2}$ in. across.

- D. Margin of lvs. usually ciliate:
lvs. persistent.....13. *præcox*
DD. Margin of lvs. glabrous.
E. Lvs. obtuse or obtusish at the
ends, sometimes partly
persistent.....14. *dahuricum*
EE. Lvs. acute at the ends, decidu-
ous: fls. larger.....15. *mucronula-*
[florum
AA. Corolla with a cylindric tube thrice as
long as the lobes.....16. *jasmini-*

1. *micranthum*, Turcz. Shrub, to 8 ft.: lvs. lanceolate or oblanceolate, obtuse or acutish, glabrous above, densely ferrugineous-lepidote beneath, $\frac{3}{4}$ – $1\frac{1}{2}$ in. long: fls. in dense many-fl. clusters, white, campanulate, $\frac{1}{2}$ – $\frac{3}{4}$ in. across, lobes oblong or oval, longer than tube; stamens longer than corolla, glabrous; style shorter than stamens; sepals lanceolate, ciliate, $\frac{1}{2}$ in. long. June, July. Manchuria to W. and Cent. China. B.M. 8198.—Very distinct species, resembling *Ledum* with its dense clusters of small white fls. and exserted stamens and with its small lvs. It has proved perfectly hardy at the Arnold Arboretum and is very floriferous even as a small plant.

2. *ferrugineum*, Linn. Shrub, 2 ft. high, glabrous: lvs. elliptic to oblong-lanceolate, acute, densely lepidote beneath, 1–2 in. long: clusters many-fl.; calyx-lobes short, obtuse; corolla funnelform-campanulate, with the tube about twice as long as limb, pink or carmine, about $\frac{1}{2}$ in. across. June–Aug. Mountains of Cent. Eu. L.B.C. 1:65. Gn. 29, p. 358. G. 8:610.—Dwarf, hardy shrub, handsome for rockeries. Var. *album*, Sweet, has white fls.

3. *hirsutum*, Linn. Shrub, 3 ft. high, with hirsute branches: lvs. oval to oblong, ciliate, light green and glandular-lepidote beneath, $\frac{1}{2}$ –1 in. long: clusters many-fl.; calyx-lobes lanceolate, as long as ovary; corolla similar to that of the preceding, lobes shorter. June, July. Alps. L.B.C. 5:479. B.M. 1853. L.D. 6:425.—Much like the preceding, but usually thrives better in cult. and does not dislike limestone soil.

4. *arbutifolium*, Hort. (*R. daphnoides*, *R. Hammondii*, and *R. oleaeifolium*, Hort. *R. Wilsonii*, Hort., not Nutt.). A hybrid of *R. ferrugineum* and *R. minus*. Dense shrub, 4 ft. high: lvs. elliptic to elliptic-lanceolate, acute at both ends, $1\frac{1}{2}$ –3 in. long: fls. similar to those of *R. ferrugineum*, but larger. June, July.—Of garden origin. Handsome hardy shrub, perhaps best known under the name of *R. Wilsonii*; this name, however, had been given previously to another hybrid between two Himalayan species and should not be used for this plant.

5. *myrtifolium*, Lodd. (*R. ovalifolium*, Hort. *R. ovatum*, Hort., not Hook.). Hybrid between *R. minus* and *R. hirsutum*, much like the preceding, but lvs. generally smaller and broader, less densely lepidote beneath, 1– $2\frac{1}{2}$ in. long, sometimes sparingly ciliate when young: fls. longer-pedicelled and calyx-lobes narrower and longer. June, July. L.B.C. 10:908.—Originated in the nursery of Loddiges.

6. *minus*, Michx. (*R. punctatum*, Andr. *R. Cuthbertii*, Small). Straggling shrub, to 10 ft.: lvs. elliptic to elliptic-lanceolate, acute at both ends, sometimes acuminate, glabrous above, glandular-lepidote beneath, $1\frac{1}{2}$ –4 in. long: heads about 6–8-fl.; calyx short; corolla funnelform-campanulate, about 1 in. across, rosy pink, the upper lobe spotted greenish, lepidote outside; tube nearly cylindric, longer than the ovate crisped lobes. June, July. N. C. to Ga. and Ala. B.M. 2285.—Fls. appear with or after the new lvs. Var. *Harrisonii*, Rehd. Fls. larger, $1\frac{1}{2}$ in. across, in dense, about 10-fl. heads. Ga. Handsomer than the type.

7. *carolinianum*, Rehd. (*R. punctatum*, Small, not Andr.). Shrub, to 6 ft., usually low and compact: lvs. oval to narrow-elliptic, acutish or shortly and abruptly acuminate, broadly cuneate at the base, glabrous above, ferrugineous-lepidote beneath, often very densely so,

2–3 in. long: fls. in dense 5–10-fl. heads, broadly funnelform-campanulate, about $1\frac{1}{2}$ in. across, pale rosy purple or rarely whitish, not or only slightly spotted; tube gradually widened, as long or shorter than the ovate lobes, glabrous or nearly so outside. May, June. N. C. B.R. 37. G. 31:619 (as *R. punctatum*).—On account of its compact habit and larger fls. superior as an ornamental plant to the preceding.

8. *Keiskei*, Miq. Low, sometimes procumbent shrub: lvs. elliptic to lanceolate, acute, dull green above, lepidote beneath, $1\frac{1}{2}$ –3 in. long: clusters 2–5-fl.; calyx minute; corolla broadly funnelform, divided to the middle into rounded lobes, pale yellow, $1\frac{1}{2}$ in. across; stamens much exserted. May. Japan. B.M. 8300.

9. *Augustini*, Hemsl. Shrub, to 20 ft.: branchlets pubescent while young: lvs. elliptic-ovate to oblong-lanceolate or lanceolate, acute or acuminate, broadly cuneate at the base, pale green beneath and lepidote and hirsute on the midrib and petiole, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long: fls. 3–6; calyx-lobes short, ciliate; corolla broadly campanulate, $1\frac{1}{2}$ –2 in. across, pale purple or rosy pink, rarely nearly white; lobes much longer than tube; stamens as long or slightly shorter than corolla, style longer. Cent. and W. China. B.M. 8497. G.C. III. 52:4. F.S.R. 3:162. R.H. 1909, p. 18.

10. *yunnanense*, Franch. Shrub, to 6 ft.: lvs. elliptic-lanceolate, acute, cuneate at the base, with scattered stiff hairs above and on the margin, or sometimes nearly glabrous, pale green below and sparsely lepidote, $2\frac{1}{2}$ –3 in. long: fls. 3–8; calyx minute; corolla broadly funnelform, 2 in. across, white, the upper lobes spotted blood-red, lobes longer than tube; stamens about as long as lobes, style longer. May. S. W. China. B.M. 7614. G.C. III. 39:399; 46:68; 54:396. G. 32:69; 36:305. Gn. 78, p. 317. M.D.G. 1903:173. F.S.R. 2:360.

11. *yanthinum*, Franch. (*R. concinnum*, Hemsl. & Wilson and Hort., not Hemsl. *R. Benthaminum*, Hemsl. *R. atroviride*, Dunn). Shrub, to 10 ft.: lvs. ovate-elliptic, acute, rounded or sometimes broadly cuneate at the base, glaucous and rather densely lepidote beneath, $1\frac{1}{4}$ – $2\frac{1}{2}$ in. long: fls. 3–6; calyx minute; corolla funnelform-campanulate, $1\frac{1}{4}$ in. long and as broad, purple or rosy purple, sometimes white, glabrous outside, tube about as long as lobes; stamens somewhat shorter than lobes, style longer. June. W. China. Var. *lepidanthum*, Rehd. & Wilson. Corolla lepidote and pubescent outside, dark purple: lvs. broader.

12. *racemodum*, Franch. Shrub, to 6 ft.: lvs. elliptic to oval or obovate, obtuse or acutish, rounded or broadly cuneate at the base, glabrous above, glaucous below and lepidote, $\frac{3}{4}$ – $1\frac{1}{4}$ in. long: fls. 1–3, from axillary buds usually crowded at the end of the branches, sometimes along the branches; corolla funnelform-campanulate, $\frac{3}{4}$ in. across, rose-pink, lobes oblong, about as long as tube; stamens and style exserted. B.M. 7301. G.C. III. 12:63; 47:343. Gn. 42:320. G. 28:224. Gt. 57:1577, pp. 562, 563. G.W. 6, p. 43 (as *R. rigidum*); 14, p. 271. R.H. 1912, p. 134.—It flowers profusely when still very small.

13. *præcox*, Carr. Hybrid between *R. ciliatum* and *R. dahuricum*. Low shrub with persistent, elliptic or oval lvs., sparingly ciliate or glabrous, ferrugineous-lepidote beneath, 1–2 in. long: clusters few-fl.; calyx-lobes ovate, ciliate; corolla broadly funnelform, pale purple or lilac, $1\frac{1}{2}$ in. across. March, April. Of garden origin. R.H. 1868:210. Gn. 38:32; 59, p. 277; 61, p. 428; 71, p. 151. G.C. II. 17:295; III. 12:771. Gt. 50, p. 135; 56:1567. G.W. 5, p. 267. G. 35:109.—Less hardy than the following species, but handsomer. Here belongs also Early Gem, with larger pale lilac fls. and the lvs. somewhat more ciliate. G.C. II. 9:336.

14. *dahuricum*, Linn. (*Azalea dahurica*, Koch). Shrub, to 10 ft.: lvs. deciduous or sometimes partly

persistent, very short-petioled, oval to oval-oblong, obtuse at both ends, revolute at the margin, ferruginous-lepidote beneath, $\frac{3}{4}$ – $1\frac{1}{2}$ in. long: fls. 1–3 at the end of the branchlets; corolla rotate-funnelform, rose-colored, 1 in. across; stamens about as long as lobes, style longer. March, April. Siberia, N. China, Kamchatka. B.M. 636. L.B.C. 7:605. G.C. II. 17:295; III. 12:701; 53:51. Gn. 77, p. 18. G.W. 7, p. 415. Var. *sempervirens*, Sims (var. *atrovirens*, Edw.). Lvs. dark green, almost persistent: fls. violet-purple. B.M. 1888. B.R. 194. L.B.C. 16:1584. Gt. 53, pp. 267, 268. R.H. 1908, p. 198.

15. *mucronulatum*, Turcz. (*R. dahuricum* var. *mucronulatum*, Maxim.). Fig. 3382. Upright shrub, attaining 6 ft.: lvs. elliptic to oblong, acute at both ends, slightly crenulate, sparingly lepidote on both sides, bright green above, pale beneath, 2–3 in. long: fls. 3–6, short-pedicelled; corolla rotate-funnelform, divided to the middle into oval rounded lobes, rose-colored, $1\frac{1}{2}$ in. across. March, April. Manchuria, N. China, Korea, Japan. G.F. 9:65 (adapted in Fig. 3382). M.D. 1898:1.



3383. *Rhododendron arboreum*. ($\times \frac{1}{2}$)

B.M. 8304.—Hardy shrub valuable for its very early fls. (it is the earliest of all hardy rhododendrons) and for its handsome scarlet fall coloring.

16. *jasminiflorum*, Hook. Small shrub: lvs. subverticillate, obovate to oblong, acute, glabrous, lepidote beneath, $1\frac{1}{2}$ –3 in. long: clusters many-fl'd.; pedicels short; calyx minute; corolla almost salver-shaped, with the tube 2 in. long and with spreading limb, fragrant, white, blushed outside below the limb, the anthers forming a red eye; style shorter than stamens, included. Winter. Java, Malacca. B.M. 4524. I.H. 6:203. J.F. 1:41. G. 32:145.—A distinct species, very unlike other rhododendrons; it requires a warm greenhouse.

Section 2. LEORHODIUM.

- A. Under side of lvs. tomentose or pubescent.
- B. Ovary tomentose: branchlets tomentose or nearly glabrous.
- C. Corolla distinctly campanulate; lobes much shorter than tube; pedicels about $\frac{1}{2}$ in. long: tall shrub or tree, tender.....17. *arboreum*

CC. Corolla funnelform-campanulate;

pedicels $\frac{3}{4}$ –2 in. long.

D. Lvs. acute at both ends.

E. Tomentum of lvs. beneath and of branchlets whitish or pale brown.....18. *Smirnovii*

EE. Tomentum of lvs. beneath and of branchlets deep brown.

F. Corolla 5-lobed, spotted

greenish.....19. *caucasicum*

FF. Corolla 5-7-lobed, spotted

purple.....20. *Metternichii*

DD. Lvs. obtuse or obtusish at both

ends.....21. *brachycarpum*

BB. Ovary and branchlets glabrous.....22. *campanula-*

AA. Under side of lvs. glabrous or pubescent

only when young.

B. Plants with coriaceous persistent lvs.

C. Ovary glabrous or glandular only.

D. Pedicels puberulous; ovary

glandular; stamens 10.....23. *ponticum*

DD. Pedicels glabrous; ovary gla-

brous; stamens 13–15.....24. *sutchuenense*

CC. Ovary tomentose or pubescent.

D. Calyx-lobes much shorter than

ovary.

E. Pubescence of ovary rusty

hirsute; pedicels glabrous.....25. *californicum*

EE. Pubescence of ovary glandu-

lar; pedicels pubescent.....26. *catwabiense*

DD. Calyx-lobes nearly as long as

ovary: lvs. acute at both ends.. 27. *maximum*

BB. Plants with rather thin lvs. falling

off the second spring: hybrids be-

tween this and the following section 28. *azaleoides*

17. *arboreum*, Smith. Fig. 3383. Large shrub or tree, attaining 40 ft.: lvs. oblong to lanceolate, acute, rugose above, distinctly veined and whitish or ferruginous-tomentose beneath, 4–6 in. long: clusters dense; pedicels short; calyx minute; corolla campanulate, blood-red, pink, or white, usually spotted, $1\frac{1}{2}$ in. across; ovary ferruginous-woolly, usually 7–9-celled. March–May. Himalayas. B.R. 890. P.M. 1:101. Gn. 64, p. 415. G.W. 6, p. 595. Var. *album*, DC. (*R. album*, Sweet, not Blume). Fls. white, spotted purple: lvs. ferruginous beneath. G. C. III. 29:246. Var. *cinnamomeum*, Lindl. Fls. white, slightly blushed, darker spotted than the preceding: lvs. cinnamon-brown beneath. B.R. 1982. Var. *limbatum*, Hook. Fls. with rosy limb and white throat, blotched purple at base: lvs. white beneath. B.M. 5311. Var. *Kingianum*, Hook. (*R. Kingianum*, Watt). Shrub: lvs. broader,

strongly bullate, very dark: fls. deep scarlet; filaments rose-colored; calyx larger. G.C. III. 26:306. B.M. 7696. Var. *nilagriticum*, Clarke. Fls. rose-colored to deep crimson, spotted: lvs. ferruginous beneath. B.M. 4381. Gn. 36:54. Var. *puniceum*, DC. Fls. purple or scarlet: lvs. white beneath. Var. *Windsorii*, Voss (*R. Windsorii*, Nutt.). Fls. deep crimson-scarlet; calyx with elongated lobes: lvs. white beneath. B.M. 5008.—This species is tender and suited only for warmer temperate regions, but has been crossed with hardy varieties and its blood is recognizable in many of our most beautiful hardy hybrids.

18. *Smirnovii*, Trautv. Shrub or small tree, to 20 ft.: young branchlets whitish or grayish woolly: lvs. elliptic-oblong, acutish, narrowed at the base into a short petiole, revolute at the margin, dark green with yellow midrib above, densely felted grayish white or pale brown beneath, 3–5 in. long: fls. many, in a compact head; calyx small, tomentose; corolla campanulate-funnelform, rosy red, 3 in. across; lobes oval, longer than tube, with crisped darker rose-colored margin, upper lip spotted brownish; stamens 10, curved; ovary

tomentose. May. Caucasus. B.M. 7495. R.H. 1899: 500. G.C. III. 20:15; 49:417. Gt. 35:1226. G.W. 16, p. 147. M.D.G. 1909:356.

19. *caucasicum*, Pall. Dense low shrub, 2 ft. high, often with procumbent branches: lvs. oval-oblong or narrow-elliptic, acute, dark green above, ferrugineous-tomentose beneath, 2-4 in. long: clusters 7-10-fl.;



3384. *Rhododendron brachycarpum*. ($\times \frac{1}{4}$)

pedicels short; calyx minute; corolla funnelform-campanulate, with emarginate rounded lobes, pink to yellowish white, spotted greenish within, $1\frac{1}{2}$ in. across. June, July. Caucasus. B.M. 1145.—A dwarf, quite hardy species; late-flowering. Var. *flavidum*, Regel. Fls. straw-colored, spotted greenish within. Gt. 16:560. Var. *stramineum*, Hook., is similar, but with fulvous spots. B.M. 3422. Var. *roseo-album*, Briot., with blush fls., changing to white, and var. *splendens*, Briot., with deep pink fls., are said to bloom very early and may be hybrids. R.H. 1868:311. Also "*Coriaceum*" and "*Rosa mundi*" (see p. 2932) are apparently forms of this species.

20. *Métternichii*, Sieb. & Zucc. (*R. Hymenanthus*, Makino. *R. japonicum*, Schneid., not Suring.). Shrub, 4 ft. high: lvs. oblong or oblong-lanceolate, narrowed at both ends, acute or obtuse, ferrugineous-tomentose beneath, 3-6 in. long: clusters 8-15-fl.; calyx minute; corolla campanulate, usually 7-lobed, rose-colored, spotted purple within, $1\frac{1}{2}$ -2 in. across; stamens usually 14. May, June. Japan. S.Z. 1:9. G. 32:91.—Like the preceding hardy, but rare in cult. Var. *pentamerum*, Maxim. Corolla 5-lobed; stamens 10 or 11. B.M. 8403. S.I.F. 2:60. Var. *angustifolium*, Bean. Lvs. narrower, to 7 in. long: fls. pale lilac-rose: of stiffly erect habit.

21. *brachycarpum*, Don. Fig. 3384. Shrub, 4 ft. high, sometimes 10 ft.: lvs. oval to oblong, rounded at both ends, mucronulate at the apex, bright green above, whitish or ferrugineous-tomentulose beneath, $2\frac{1}{2}$ -6 in. long: fls. in dense clusters, short-pedicelled; calyx-lobes short; corolla funnelform-campanulate, creamy white, spotted greenish within, $1\frac{1}{2}$ -2 in. across. June. Japan. G.F. 1:293 (adapted in Fig. 3384). B.M. 7881. G. 28:345.—Has proved quite hardy, but is still rare in cult.

22. *campanulatum*, Don. Shrub, attaining 16 ft.: lvs. elliptic to elliptic-oblong, usually rounded at both ends, ferrugineous-tomentose beneath, 3-6 in. long: clusters many-fl.; pedicels short; calyx-lobes short; corolla funnelform-campanulate, pale purple or pale lilac or almost white, with few purple spots, 2 in. across. June. Himalaya. B.M. 3759. L.B.C. 20:1944. Gn. 48, p. 108; 59, p. 294. G. 28:463. H.U. 1, p. 255.

—This is one of the hardiest of the Himalayan species. Var. *aeruginosum*, Nichols. (*R. aeruginosum*, Hook. f.). Lvs. with verdigris-colored tomentum beneath. Var. *Batemanii*, Nichols. (*R. Batemanii*, Hook.). Of more robust habit and with larger fls. B.M. 5387. Var. *Wallichii*, Hook. Lvs. with lax, often caducous tomentum, and with densely woolly petioles: corolla more highly colored. B.M. 4928.

23. *ponticum*, Linn. Shrub, 10 ft. high: lvs. elliptic to oblong, acute, pale green beneath, 3-5 in. long: clusters many-fl.; pedicels longer than fls., puberulous; calyx-lobes as long as ovary, the lower ones half as long; corolla funnelform-campanulate with oval lobes, purple, spotted brownish within, about 2 in. across; ovary glandular. May, June. Spain, Portugal, Asia Minor. B.M. 650.—This species is less hardy than the two preceding and now rarely found in cult. in its typical form. Var. *album*, Hort., has white fls. There are also varieties with variegated and one with purplish lvs.

24. *sutchuenense*, Franch. Shrub, to 15 ft.: lvs. oblong-oblongate, usually obtuse, narrowed at the base, dark green above, paler and glabrous beneath, 4-10 in. long; petioles stout, $\frac{3}{4}$ - $1\frac{1}{2}$ in. long: fls. many, in a dense head; pedicels glabrous; corolla funnelform-campanulate, 2-2 $\frac{1}{2}$ in. across, rose-colored, spotted below the base of the upper lobes, lobes broad, rounded, shorter than tube; stamens 13-15, shorter than the corolla, anthers purple-black; style glabrous, as long as the stamens; ovary glabrous. W. China. B.M. 8362.—Blooms freely as a small plant 2 ft. high.

25. *californicum*, Hook. Shrub, 8 ft. high, sometimes to 20 ft., glabrous: lvs. oblong, shortly acuminate, pale green beneath, 3-6 in. long, sometimes crowded beneath the fls.: clusters many-fl.; calyx minute; corolla broadly campanulate, with oval crisped lobes, rosy purple or pink, paler toward the center, spotted yellow within, about 2 in. across, rich carmine in bud; stamens 10, with purple anthers; ovary with appressed silky hairs. May, June. Calif. to Brit. Col. B.M. 4863.—*R. macrophyllum*, Don, and *R. washingtonianum*, Hort., are probably not different.

26. *catawbiense*, Pursh. Figs. 3385, 3386. Shrub, 6 ft. high, rarely 20 ft.: lvs. rounded at base, oval to



3385. *Rhododendron catawbiense*. ($\times \frac{1}{5}$)

oblong, usually obtuse and mucronulate, glaucous beneath, 3-5 in. long: clusters many-fl.; pedicels rusty pubescent; corolla broadly campanulate, with broad roundish lobes, lilac-purple, about $1\frac{1}{2}$ in. across; ovary rusty tomentose. June. Va. to Ga., in the mountains. B.M. 1671. L.B.C. 12:1176. Gn.M. 2:18. F.E. 17:312 (pl. 71). M.D.G. 1902:381. G.W. 4, p. 97. G. 37:391.—One of the most beautiful of native shrubs, covering extensive tracts of land on the higher mountains of the

southern Alleghanies. Hardy as far north as New England.

27. *maximum*, Linn. GREAT LAUREL. Fig. 3387. Shrub, or small tree, attaining 35 ft.: lvs. mostly acute at base, narrow-oblong or lanceolate-oblong, acute or shortly acuminate, whitish beneath, 4–10 in. long: clusters many-fld.; pedicels viscid; calyx-lobes oval, as long as ovary; corolla campanulate, deeply 5-lobed with oval lobes, usually rose-colored, spotted greenish within, about 1½ in. across; ovary glandular. June, July. Nova Scotia and Ont. to Ga. B.M. 951. Em. 2:435. Mn. 1:1 and 3, p. 22. C.L.A. 3:32; 4:105. G.W. 15, p. 623.—This is one of the hardiest species, being hardy as far north as Que. and Ont. Three varieties have been distinguished: var. *album*, Pursh (*R. Purshii*, Don), with white fls.; var. *purpureum*, Pursh (*R. purpureum*, Don), with purple fls., and var. *roseum*, Pursh, with pink fls. This species and the following are now often extensively used in park-planting and taken by the carloads from the woods. If properly handled and taken from a turfy soil with a sufficient ball of earth around the roots, they are usually successfully transplanted.

28. *azaleoides*, Desf. (*R. fragrans*, Lodd. *R. odoratum*, Paxt.). Hybrid between *R. minus* and *R. nudiflorum*. Shrub, a few feet high: lvs. leathery but thin, elliptic to oblong, acute at both ends, dark green above, paler beneath, sometimes pubescent when young; fls. funnel-form-campanulate, pinkish or whitish, fragrant, 1½–2 in. across; calyx with ciliate lobes. May, June. P.M. 10:147. J.H. III. 49:489.—Of garden origin. There are many allied forms of similar origin described under different names. The name *Azaleodendron* has been proposed as a generic name for the hybrids between *Azalea* and *Rhododendron* by Rodigas. To this group of hybrids also belong *R. Smithii aureum*, Hort., with yellow fls. F.S.R. 2:152, and *R. Broughtonii aureum*, Hort., similar, but with deeper yellow fls. and with the under side of the lvs. green, not glaucescent as in the preceding form (G.C. III. 51:53); also *R. Cartonianum*, DC., *R. gemmiferum*, Bean, and *R. Goewenianum*, Sweet (see suppl. list).



3387. *Rhododendron maximum*. (×¼)

Subgenus II. AZALEA.

Section 3. AZALEASTRUM.

29. *albiflorum*, Hook. (*Azalea albiflora*, Kuntze. *Azaleastrum albiflorum*, Rydb.). About 2–3 ft.: branches strigose and glandular when young: lvs. oblong, pale green, appressed-strigose above and at the midrib beneath, slightly ciliate: fls. nodding, on short pedicels; corolla white, 5-cleft, about 1 in. broad; calyx glandular; stamens 10. Rocky Mts. B.M. 3670. Var. *plenum*, Rehd. A very handsome double form

found wild, but not yet in cult.—The species is hardy, but difficult to cult.; will probably succeed best on a rocky in a cool and shady place.



3386. Flower-bud of *Rhododendron catawbiense*. These buds are full-formed in the fall. Unless these large terminal buds are produced, the bush will not bloom the following spring. (×¼)

Section 4. PENTANTHERA.

- A. Stamens longer than the limb; corolla-tube long and narrow, usually glandular outside.
- B. Color of fls. white or pink.
- C. Fls. with or after the lvs., white.
- D. Corolla soft-pubescent outside, with yellow stripes on the upper lobe: branchlets glabrous or finely pubescent..... 30. *occidentale*
- DD. Corolla hirsute, with stalked glands.
- E. Lvs. beneath and branchlets glabrous..... 31. *arborescens*
- EE. Lvs. strigose beneath on the midrib and branchlets strigose..... 32. *viscosum*
- CC. Fls. before the lvs., pink, rarely whitish.
- D. Lvs. strigose beneath: corolla usually not glandular..... 33. *nudiflorum*
- DD. Lvs. grayish soft-pubescent beneath: corolla glandular outside..... 34. *canescens*
- BB. Color of fls. yellow to flame-red.
- C. Ovary not glandular; stamens much longer than corolla: lvs. generally obovate..... 35. *calendula-ceum*
- CC. Ovary glandular; stamens little longer than corolla: lvs. generally oblong..... 36. *luteum*
- AA. Stamens shorter than the limb; corolla-tube short, funnel-form, finely pubescent outside, not glandular.
- B. Under side of lvs. soft-pubescent: corolla yellow..... 37. *sinense*
- BB. Under side of lvs. only strigose on the veins: corolla brick-red to carmine.. 38. *japonicum*

30. *occidentale*, Gray (*Azalea occidentalis*, Torr. & Gray. *A. californica*, Durand). Shrub, 2–6 ft.: branchlets glabrous or pubescent: lvs. obovate-oblong, finely ciliate, slightly pubescent beneath when young, 1–2 in. long: corolla 2–2½ in. long, white or slightly tinged rose, with yellow on the upper lobe, fragrant. May, June. Calif. B.M. 5005. F.S. 14:1432. Gn. 34:416. G.W. 11, p. 8; 15, p. 650.

31. *arborescens*, Torr. (*Azalea arborescens*, Pursh). SMOOTH AZALEA. Fig. 3388. From 8–20 ft.: branchlets glabrous: lvs. obovate or obovate-oblong, acute, ciliate, glabrous, green or glaucescent beneath, 2–4 in. long: fls. white or tinged rose, 2 in. long, fragrant; style and stamens red. June, July. Alleghany Mts. G.F. 1:401 (adapted in Fig. 3388). C.L.A. 11:496. Gn.M. 5:219. L.B.C. 17:1632 (as *A. verticillata*).

32. *viscōsum*, Torr. (*Azalea viscōsa*, Linn.). WHITE SWAMP HONEYSUCKLE. From 4–8 ft.: winter buds glabrous: branchlets with stiff hairs: lvs. obovate-oblong, obtuse or mucronulate, ciliate, bristly hairy on the veins beneath, 2–4 in. long: fls. white or tinged rose, 1½–2 in. long, viscid outside, fragrant; style red. June, July. E. N. Amer. Em. 2:438. Mn. 10:81. C.L.A. 11:496. Var. *nitidum*, Gray. From 1–3 ft.: lvs.



3388. *Rhododendron arborescens*. (×¼)

oblanceolate, bright green on both sides: corolla tinged red. B.R. 414. Var. *gladum*, Gray. Lvs. whitish-glaucous beneath, dull and glaucous above. L.B.C. 16:1518. Var. *hispidum*, Schneid. (*Azalea hispida*, Pursh). Pedicels bristly hispid: fls. usually pink: lvs. glaucescent beneath. L.B.C. 5:441.

33. *nudiflorum*, Torr. (*Azalea lutea*, Linn., partly. *A. nudiflora*, Linn.). PINXTER FLOWER. Figs. 3389, 3390. Height 2–6 ft.: winter buds more or less pubescent: branchlets pubescent and often with stiff hairs: lvs. oblong or obovate, strigose on the midrib beneath, 2–4 in. long: fls. pink to nearly white, before the lvs., about 1½ in. broad, strigose or slightly glandular outside, faintly fragrant; pedicels strigose-hairy. April, May. Mass. to Fla. and Texas. B.R. 120. L.B.C. 1:51. Mn. 2:17. Gn. 29, p. 550.

34. *canescens*, Don (*Azalea canescens*, Michx.). Shrub, 1–3 ft.: similar to the preceding: lvs. oval to elliptic or obovate, soft-pubescent beneath, at least when young, 1½–3 in. long: pedicels glandular: fls. pink to nearly white, 1½–2 in. broad, glandular outside, very fragrant; stamens slightly exerted. April, May. N.H. to Fla. and La.

35. *calendulaceum*, Torr. (*R. luteum*, Schneid., not Sweet. *Azalea calendulacea*, Michx. *A. lutea*, Linn., partly. *A. aurantiaca*, Dietr. *A. speciosa*, Willd.). FLAME-COLORED AZALEA. From 4–10 ft.: branchlets glabrous or with stiff hairs: lvs. obovate or ovate, usually pubescent beneath, serrulate-ciliate: fls. orange-yellow to orange-red or flame-red, often 2 in. broad, with the lvs., nearly scentless; tube usually shorter than the limb; stamens thickened at the middle. May,

June. E. N. Amer. C.L.A. 11:496. Gn. 29, p. 550. B.R. 145. L.B.C. 7:624. B.M. 180. Var. *croceum*, Rehd. Fls. yellow or orange-yellow. B.M. 1721. L.B.C. 14:1324.—One of the most showy species.

36. *luteum*, Sweet (*R. flavum*, Don. *Azalea pontica*, Linn.). Shrub, 2–6 ft.: branchlets hairy: pedicels and petioles glandular: lvs. cuneate, oblong, usually hairy on both sides when young, 2–4 in. long: fls. yellow, 2–2½ in. broad, very fragrant; stamens as long as the limb. May. Orient, Caucasus. B.M. 433; 2383 (var. *albiflora*). C.L.A. 11:495. G. 27:15. Gn. 29, p. 550. G.M. 36: 500.—A very fragrant and free-flowering species, not common in cult. Nearly all varieties referred to this species in nursery catalogues are hybrids and belong to the so-called Ghent azaleas, *R. Morteri*, Sweet (*Azalea Mortieriana*, Spae. *A. gandavensis*, Hort.); see p. 2935.



3389. *Rhododendron nudiflorum*. (×¼)

37. *sinense*, Sweet (*R. molle*, Don. *Azalea sinensis*, Lodd. *A. mollis*, Blume). Shrub, to 5 ft.: young branchlets pubescent and often setose: winter buds grayish pubescent: lvs. oblong to oblong-oblanceolate, obtuse and mucronate, cuneate at the base, ciliate and often revolute at the margins, soft-pubescent beneath, 2½–3½ in. long: fls. in many-fld. heads; pedicels puberulous; calyx-lobes short, rounded, ciliate; corolla campanulate-funnelform, yellow, upper lobe spotted greenish, 2 in. across; stamens shorter than limb. April, May. China. B.R. 1253. L.B.C. 9:885.—Tenderer than the following species with which it has been confused. It has entered largely into the parentage of the so-called Ghent azaleas, and some of them, particularly Anthony Koster, are little different from true *R. sinense*.

38. *japonicum*, Suring. (*R. molle*, Miq., not Don. *Azalea japonica*, Gray. *A. mollis*, Hort., not Blume). Fig. 3392. Shrub, to 6 ft.: young branchlets glabrous, sometimes setose: winter buds glabrous: lvs. obovate to obovate-oblong, obtuse and mucronate, cuneate at the base, ciliate, glabrous or sparingly setose above, glabrous below except setose on the midrib, 1½–3 in. long: fls. in dense heads; pedicels setose; calyx-lobes ovate, setose; corolla campanulate-funnelform, 2 in. across, salmon-red, brick-red, or carmine; stamens shorter than limb. April, May. Japan. F.S. 19:2032–6. Gn. 29, p. 551; 33, p. 324; 42, p. 369; 46, p. 546; 59:403. Gn.M. 4:24. C.L.A. 4:210; 5:147; 11:495. Gt. 16:556; 57:1575. M.D.G. 1906:556. G. 2:503; 5:219. Gng. 4:279. S.I.F. 2:62.—This and the preceding species have been hybridized extensively with *R. luteum* and the American azaleas and almost all the varieties now in trade under the names of these two species are hybrids. The type of *R. japonicum* has been reintrod. from Japan by C. S. Sargent and that of *R. sinense* from China by E. H. Wilson, and they have been distributed by the Arnold Arboretum. *R. japonicum* is hardy at the Arnold Arboretum; *R. sinense* is tenderer, but stands ordinary winters in favorable positions.



3390. Capsule of *Rhododendron nudiflorum*.

Section 5. RHODORA.

- A. Stamens 10; corolla rosy purple, not spotted 39. *canadense*
 AA. Stamens 7 or 5; corolla pale rose-colored, spotted 40. *Vaseyi*

39. *canadense*, Zabel (*R. Rhodora*, Don. *Rhodora canadensis*, Linn. 1-3 ft.: lvs. oval to oblong, obtuse and mucronulate, glaucous and slightly pubescent beneath, 1-2½ in. long; fls. 5-7, on very short pedicels, before the lvs.; corolla 2-lipped, the two lower segms. narrow, divided nearly to the base, rose-purple, not spotted, 1-1½ in. broad; stamens 10. April, May. Newfoundland to Que., south to Pa. and N. J. Em. 2:441. B. M. 474. C.L.A. 11:496. Gn.M. 5:221. G.W. 9, p. 474; 14, p. 85. M.D.G. 1902:286; 1906:73.

3391. *Rhododendron Vaseyi*. (× ¾)

40. *Vaseyi*, Gray (*Azalea Vaseyi*, Rehd. *Biltia Vaseyi*, Small). Fig. 3391. From 5-15 ft. high: branchlets without bristles; lvs. oblong or oblong-lanceolate, acute, sparsely hirsute, 2-5 in. long; fls. before the lvs.; corolla rotate-campanulate, slightly 2-lipped, divided to below the middle, pale rose-colored, 1½ in. across, upper lobes spotted, lower lobes widely spreading, divided nearly to the base; stamens 7, rarely 5. April, May. N. C. G.F. 1:377 (adapted in Fig. 3391). G.C. III. 20:71; 51:313. B.M. 8081. Gn. 76, p. 332; 79, p. 302. Mn. 7:121. C.L.A. 11:499. Gn.M. 5:219. M.D.G. 1899:332, 333. G.W. 16, p. 231.—A very handsome, hardy species. There is also a form with white fls., var. *album*, Rehd., but this is not quite so beautiful as the type.

Section 6. TSUTSUTSI (Tsusia).

- A. Corolla rotate-campanulate, divided to below the middle: lvs. deciduous.
 B. Lvs. rhombic-ovate, acute: corolla not spotted 41. *rhombicum*
 BB. Lvs. obovate, obtuse: upper lobes of corolla spotted 42. *Schlippenbachii*
 AA. Corolla funnel-form-campanulate: lvs. deciduous or persistent.
 B. Inner bud-scales viscid when unfolding.
 C. Sepals obtuse, ciliate, not glandular 43. *poukhanense*
 CC. Sepals acute, lanceolate, glandular-ciliate 44. *ledifolium*
 BB. Inner bud-scales not viscid.
 C. Fls. solitary, 2-3 in. across; anthers purple; sepals small, ovate: lvs. persistent, lustrous above 45. *indicum*
 CC. Fls. 2-3, smaller: lvs. subpersistent or deciduous, dull.
 D. Stamens 7-10, anthers purple; sepals ovate to lanceolate: lvs. elliptic, acute, subpersistent, 1-2 in. long 46. *Simsii*
 DD. Stamens 5; anthers usually yellow.

- B. Lvs. deciduous, elliptic, acute, 1-2½ in. long; fls. 1½-2 in. across, anthers yellow 47. *Kaempferi*
 BB. Lvs. subpersistent, obovate to elliptic, obtuse or acutish, ½-1½ in. long; fls. ½-1½ in. across; anthers sometimes purple 48. *obtusum*

41. *rhombicum*, Miq. (*Azalea rhombica*, Kuntze). Shrub, 3-8 ft.: lvs. rhombic-ovate to rhombic-elliptic, acute at both ends and sparsely hairy above, yellowish pubescent at the nerves beneath, 1½-2½ in. long; fls. 2-3; corolla 1½-2 in. broad, rotate-campanulate, bright rose-colored, segms. oblong, not spotted; stamens 10. April, May. Japan. B.M. 6872. Gt. 17:586. G.C. III. 20:38. Gn. 72, p. 267. R.H. 1909, p. 79. Var. *albiflorum*, Makino. Fls. white.

42. *Schlippenbachii*, Maxim. (*Azalea Schlippenbachii*, Kuntze). Three to 5 ft.: branchlets glandular-pilose: lvs. cuncate, broadly obovate, 2-5 in. long, rounded and mucronate at the apex, hirsute on both sides or glabrous at length: fls. with the lvs., 2-3 in. broad, pale rose-colored, upper lobes spotted reddish brown; stamens 10. May. Japan. B.M. 7373. Gn. 46:80; 77, p. 136. G.C. III. 19:561; 55, suppl. Jan. 3.

43. *poukhanense*, Léveillé (*R. coreanum*, Rehd.). Spreading shrub, 1-3 ft.: lvs. chartaceous, subpersistent, narrow-elliptic to elliptic-lanceolate, or lanceolate at the end of the branchlets, dark green above and usually sparingly strigose, paler beneath and strigose on the veins, 1½-2½ in. long; fls. 1-3; the inner scales of the bud viscid; sepals ¼-½ in. long, ovate-oblong, obtuse, strigose and long-ciliate; corolla funnel-form-campanulate, pale lilac-purple, spotted purplish brown on the upper lobes, about 2 in. across; stamens 10, anthers purple. May. Korea.—Has proved perfectly hardy at the Arnold Arboretum and flowers freely as a small plant; the purple-lilac color of the fls. is unique among hardy azaleas. Var. *yodogawa*, Rehd. (*Azalea yodogawa*, Hort.). Fls. double, rosy lilac, spotted dark purple: lvs. elliptic-lanceolate. G.W. 16:163. R.H. 1908:425.

44. *ledifolium*, Don (*R. rosmarinifolium*, Dipp., not Vidal. *Azalea rosmarinifolia*, Burm. *A. alba*, Sweet. *A. ledifolia*, Hook. *A. liliiflora*, Poit.). Much-branched low shrub, 1-3 ft.: branches, lvs. and pedicels densely rufously appressed - strigose: lvs. elliptic or elliptic-lanceolate, persistent, 1-3 in. long; fls. 1-3; sepals lanceolate, serrate - glandular; corolla pure white or rosy purple, 2-3 in. broad, fragrant; stamens usually 10. May. China. B.R. 811. B.M. 2901. L. B. C. 13:1253. G. 28:323. Gn. 33, p. 321. G.W. 15, p. 650.—Some remarkable varie-

3392. *Rhododendron japonicum*. (× ¾)

ties of this species are the following: Var. *album*, Rehd. (*R. ledifolium* var. *leucanthum*, DC. *A. indica* var. *alba*, Lindl. *R. leucanthum*, Bunge). Fls. white, sometimes striped pink. G.C. III. 33:373. Gn. 54, p. 487. G. 6:607. Var. *Noordtianum*, Rehd. (*Azalea ledifolia* *Noordtiana*, Wittm. *A. japonica alba grandiflora* Van Noordt, Hort.). Fls. white, larger: lvs. elliptic. R.B. 30:133. M.D.G. 1905:73, 74. Gt. 59, p. 310. G.W. 15, p. 45. Said to be the hardiest variety of this species. Var. *purpureum*, Maxim. Fls. rosy purple. Var. *narcissiflorum*, Maxim. (*A. narcissiflora*, Fort.). Fls. double, white, rarely purple. F. 1880:89. Var. *phanceum*, DC. (*A. punicea*, Sweet. *A. ledifolia* var. *phancea*, Hook. *A. indica* var. *calycina*, Paxt.). Fls. single, purple; calyx with linear, not serrate and less glandular lobes. B.M. 3239. L.B.C. 18:1735. J.F. 3:257. Possibly a hybrid of this species and *R. sub-lanceolatum*.—*R. ledifolium* has produced, with *A. indica*, a large number of beautiful hybrids, of which one of the first was figured in 1833 as *R. pulchrum*.

45. *indicum*, Sweet (*R. macranthum*, Don. *R. Danielsianum*, Planch. *Azalea indica*, Linn. *A. macrantha*, Bunge. *A. Danielsiana*, Paxt.). Low, much-branched shrub: lvs. evergreen, elliptic to lanceolate-oblong, obtuse or acute, dark green and lustrous above, paler and slightly strigose below, 1-2 in. long: fls. usually solitary; sepals small, ovate, ciliate; corolla funnel-form, 2-3 in. across, rosy purple to pink; stamens 5-10, anthers purple. June, July. Japan. P.M. 1:129. Var. *crispiflorum*, Schneid. (*Azalea crispiflora*, Hook.). Fls. large, rose-colored, with distinctly crisped segms. B.M. 4726. F.S. 9:887. Var. *lateritum*, Rehd. (*Azalea indica* var. *lateritia*, Lindl.). Fls. salmon- or brick-red: lvs. oblong-lanceolate. B.R. 1700. Var. *rosiflorum*, Rehd. (*Azalea rosiflora*, Flor. Mag. A. *balsaminiflora*, Carr. A. *Röhlssonii*, Hort.). Lvs. oblong-lanceolate: fls. salmon-red, very double, with imbricated oblong segms., resembling the fl. of a camellia-fld. balsam. F.M. 19:418. Gn. 18:254. R.H. 1882:432. F. 1878, p. 35. G.Z. 29, p. 265.—This species is the origin of most of the beautiful garden forms of Indian azaleas raised by hybridizing with the allied species, particularly *R. Simsii* and *R. ledifolium*; many of the forms were intro. from Chinese and Japanese gardens. Gn. 33, p. 139; 50, p. 192; 54, p. 487; 73, p. 202. G.C. III. 24:101. R.B. 20:121; 23:37; 25:73. A.G. 14:473. Gng. 4:359. F.E. 9:431. F.R. 2:579. C.L.A. 7:479. Gn.M. 5:220.

46. *Simsii*, Planch. (*R. indicum* var. *Simsii*, Maxim. *R. indicum* var. *ignescens*, Sweet. *Azalea indica*, Sims, not Linn.). Half-evergreen or evergreen shrub, to 10 ft.: lvs. elliptic-ovate to elliptic-lanceolate, rarely lan-



3393. *Rhododendron Kaempferi*. (×½)

ceolate, acute, cuneate at base, sparingly strigose and dull above, more densely so beneath, at least on the veins, $\frac{3}{4}$ -2 in. long: fls. 2-3, sepals ovate to lanceolate, densely strigose and ciliate; corolla funnel-form, $1\frac{1}{2}$ -2 in. across, carmine or rose-colored; stamens 7-10; anthers purple. May, June. W. China. B.M. 1480. L.B.C. 3:275.—The typical form has been recently re-intro. by E. H. Wilson.

47. *Kaempferi*, Planch. (*R. indicum* var. *Kaempferi*, Maxim.). Fig. 3393. Shrub, to 12 ft.: lvs. membranous, deciduous, broadly elliptic to elliptic-ovate or nearly rhombic, acute at the ends, bright green above, paler beneath, strigose on both sides, with rufous hairs on midrib and petiole, $1\frac{1}{4}$ -2½ in. long: fls. 2-4 with or before the lvs.; sepals oval to oblong-ovate, obtuse, long-ciliate, strigose outside; corolla broadly funnel-form, $1\frac{1}{4}$ -2 in. across, bright orange-red to pink; stamens 5; anthers yellow. April, May. Japan. S.I.F. 2:61. C.L.A. 11:496. M.D.G. 1902:417. S.T.S. 2:113.—Very handsome; hardy in New England.

48. *obtusum*, Planch. (*R. indicum* var. *obtusum*, Maxim. *Azalea obtusa*, Lindl.). Low, much-branched shrub: lvs. persistent, obovate, rounded and mucronulate at the apex, dark green and lustrous above, strigose on the midrib beneath, $\frac{3}{4}$ -1½ in. long: fls. 2-3; sepals ovate, small, ciliate; corolla funnel-form, orange-red or pink, 1-1½ in. across; stamens 5; anthers yellow. May. Japan. B.R. 32:37. G.C. II. 25:585. R.H. 1876:370. Gn. 67, p. 190. Var. *album*, Schneid. (*Azalea obtusa alba*, Hort.). Fls. white. G.F. 9:395. Var. *calyciflorum*, Schneid. (*Azalea calyciflora*, Hort.). Fls. brick-red, corolla double (hose-in-hose). Var. *amatum*, Rehd. (*R. amatum*, Planch. *Azalea amata*, Lindl.). Lvs. elliptic or elliptic-obovate, acute or obtusish, $\frac{3}{4}$ -1 in. long, dark green: corolla usually double (hose-in-hose), purple, $\frac{3}{4}$ -1 in. broad; stamens 5; anthers often purple. April, May. B.M. 4728. F.S. 9:885. G.C. III. 23: fig. 125. A.G. 15:373; 18:568. Gng. 2:385; 11:289. A.F. 12:33; 20:751. F.E. 9:573. J.F. 4:329. This variety, of which the wild parent plant is unknown, seems to have some relations to *R. Simsii* and may be of hybrid origin. It flowers early and very abundantly; hardy north to N. Y. There are some forms and crosses of this variety of which the following may be named: *album*, with white fls. M.D.G. 1903:476; *Caldwellii*, with larger purple fls. (Geert, Ic. Az. 18); G. 32:21; *Marvel*, lilac-carmine, double (F.M. 11; 14); *Princess Maud*, rosy magenta (R.H. 1886:516); *Mrs. Carmichael*, crimson-magenta; *Princess Beatrice*, bright mauve; *Prime Minister*, soft pink; *Miss Buist*, pure white; *Heze* (Firefly), deep crimson. In Japanese gardens a large number of named varieties of *R. obtusum*, varying in shades from white to deep crimson, are grown; one of the best known of them is *Hinodigiri*, with brilliant crimson fls.

Great numbers of names of rhododendrons are to be found in current literature, but the plants may be unknown in the American trade. The following list will explain most of these names. The number in parenthesis after the name refers to the section to which the species belongs. *R. adenopodum*, Franch. (2). Shrub, to 10 ft.: lvs. oblong-lanceolate, with white crustaceous tomentum beneath, 3-6 in. long: fls. 4-6, campanulate, pale rose, 2½-3 in. across; pedicels glandular. Cent. China. G.C. III. 45:291.—*R. afghanicum*, Hort., not Aitch.—*R. Collettianum*.—*R. Albrechtii*, Maxim. (*Azalea Albrechtii*, Kuntze) (5). Deciduous shrub, to 5 ft.: lvs. obovate or elliptic, pubescent, 3-5 in. long: fls. purple; stamens 10. Japan.—*R. album*, Blume (1). Small shrub: lvs. oblong-lanceolate ferrugineous-lepidote beneath, 3-4 in. long: fls. rather small, campanulate, yellowish white. Java. B.M. 4972. Tender.—*R. altaclarense*, Lindl. Hybrid of *R. arboreum* with *R. catawbiense* × *R. ponticum*. Fls. bright crimson, in dense heads. B.R. 1414. B.M. 3423. Not to be confounded with *Azalea altaclarense*, Lindl. (*R. sinense* × *R. viscosum*. B.R. 28:27).—*R. ambiguum*, Hemsl. (1). Shrub, to 10 ft.: lvs. lanceolate, glabrous above, sparingly lepidote beneath, 2-3 in. long: fls. 5-7, broadly campanulate, yellow, 2 in. across. W. China. B.M. 8400.—*R. Amesiae*, Rehd. & Wilson (1). Allied to *R. yanthinum*. Shrub, to 10 ft.: lvs. elliptic to elliptic-oblong rounded at base, lepidote, villous on the midrib above, 2-3 in. long: petioles setose: fls. 2-3, funnel-form, $1\frac{1}{4}$ -2 in. across, purple. W. China.—*R. Annæ*, Franch. Lvs. lanceolate, coriaceous: fls. white, medium-sized: corolla flat and disk-like. W. China.—*R. Anthopogon*, D. Don. Low shrub: lvs. elliptic-oblong, ferrugineous-

lepidote beneath, $1\frac{1}{2}$ in. long; fls. small, funnelform, yellowish white, $\frac{1}{2}$ in. long; stamens 5, included. Himalayas. B.M. 3947. Almost hardy.—*R. argenteum*, Hook. f.—*R. grande*.—*R. argyrophylum*, Franch. (2). Shrub, to 15 ft.: lvs. oblong-lanceolate or oblanceolate, with white crustaceous tomentum beneath, 3–6 in. long; fls. 7–10, slender-stalked, funnelform-campanulate, $1\frac{1}{2}$ in. across, pale rose-purple; stamens 14, included. W. China. Very variable.—*R. Aucklandii*, Hook. f.—*R. Griffithianum* var. *Aucklandii*.—*R. auriculatum*, Hemsl. (2). Shrub, to 15 ft.: lvs. oblong, obtuse and mucronate, auriculate at the base, rusty-tomentose beneath, 4–8 in. long; fls. 6–8, white to rosy red, funnelform, about 3 in. across; pedicels hairy; bud-scales lanceolate. Cent. China. J.H.S. 28, p. 64.—*R. balsaminiflorum*, Hort. Hybrid of the Japanese group, with double pink fls. G.C. II. 18:230; III. 12:769. Gt. 37, p. 265. G.Z. 27:241. J.H. III. 43:151. Var. *album*, Hort. Fls. double, white. Gn.W. 5:373. G.Z. 27:241. Var. *aureum*, Hort. Fls. double, yellow. G.Z. 27:241. The name has also been used for a double form of *R. indicum*, see *R. indicum* var. *rosiflorum*.—*R. barbatum*, Wall. (2). Tree, attaining 60 ft.: lvs. with setose petioles, elliptic-oblongate, glabrous and pale beneath, 5–7 in. long; fls. deep red, campanulate, $1\frac{1}{2}$ in. across, in dense clusters. Himalayas. F.S. 5:469–72. G.M. 53:261. Var. *Smithii*, Clarke. Lvs. ferruginously subtomentose beneath. B.M. 5120.—*R. blandfordiaeflorum*, Hook. (1). Slender shrub, 8 ft. high, allied to *R. cinnabarinum*: lvs. oblong-lanceolate, ferruginous-lepidote beneath, 2–3 in. long; fls. funnelform, with cylindric tube, brick- or orange-red, yellow within, $2\frac{1}{2}$ in. long. Himalayas. B.M. 4930. F.S. 11:1173. I.H. 3:112. B.H. 7, p. 47. G.C. 1856:548; 1871:236. Gn. 15:182 (as *R. cinnabarinum*).—*R. Bodhi*, Nutt. (1). Shrub, 6 ft. high, often epiphytal: lvs. ovate-oblong, or oblong-lanceolate, hirsute above when young, minutely lepidote beneath, 4–5 in. long; fls. in dense clusters, campanulate, yellow, $1\frac{1}{2}$ in. across. Himalayas. B.M. 7149. I.H. 5:174.—*R. bracteatum*, Rehd. & Wilson (1). Allied to *R. yanthinum*. Shrub, to 6 ft.: lvs. oblong, obtuse, lepidote beneath, 1–2 in. long, toward the base of the branchlets reduced to persistent bracts: fls. 3–6, white, spotted red, broadly campanulate, $1\frac{1}{2}$ in. across. W. China.—*R. Britii*, Hemsl. & Wilson.—*R. longesquamatum*.—*R. Brookeanum*, Low (1). Shrub, often epiphytal, with glabrous purple branches: lvs. oblong-lanceolate, pale beneath, 6–9 in. long; fls. funnelform-campanulate, orange- or golden-yellow, $2\frac{1}{2}$ in. across. Borneo. B.M. 4935. F.S. 5, p. 477; 12:1238, 1239. G.C. III. 9:621. Var. *flavum*, Hort. Fls. paler yellow. G.Z. 23, p. 145.—*R. Broughianii*, Hort. One of the hybrid evergreen rhododendrons of unknown parentage with bright rosy red fls.—*R. Broughianii* *aureum*, Hort. See under No. 28, *R. assaleoides*.—*R. bullatum*, Franch. (2). Shrub, to 5 ft.: branchlets woolly: lvs. elliptic-oblong or oblong-ovate, dull green and wrinkled above, with brownish tomentum beneath, 2–3 in. long; fls. 3–6, white with yellow blotch, broadly campanulate, 2 in. across, fragrant; calyx large. G.C. III. 46:378. S.W. China.—*R. burmanicum*, Hutchins. (1). Lvs. oblanceolate, densely scaly on both sides, $2\frac{1}{2}$ – $3\frac{1}{2}$ in. long; fls. greenish white, very sweet-scented. Burma.—*R. calophyllum*, Nutt. (1). Shrub, 3 ft. high: lvs. oblong-ovate or elliptic, glossy above, lepidote beneath, 3–5 in. long; fls. 4–5, tubular-campanulate, white, slightly tinged yellowish green, 3 in. across. Himalayas. B.M. 5002. F.S. 22:2340.—*R. calophyllum*, Franch. (2). Shrub or small tree, to 45 ft.: lvs. oblong-obovate, glabrous, 8–12 in. long; fls. 15–20, long-stalked, purple, rose-colored or white, broadly campanulate, 2 in. across; stamens about 20; ovary glabrous. W. China.—*R. camelliaeflorum*, Hook. f. (1). Shrub, 6 ft. high, often epiphytal: lvs. elliptic-lanceolate, ferruginous-lepidote beneath, 2–3 in. long; fls. 1–2, short-pedicelled, broadly campanulate, white or slightly tinged rose, $1\frac{1}{2}$ in. across; stamens 16. Himalayas. B.M. 4932.—*R. campylocarpum*, Hook. f. (2). Shrub, 6 ft. high: lvs. elliptic, obtuse, mucronate, glabrous and glaucous beneath, 2– $3\frac{1}{2}$ in. long; fls. several, campanulate, yellow, fragrant, to $2\frac{1}{2}$ in. across. Himalayas. B.M. 4968. Gn. 54:182; 78, p. 573. G.C. II. 21:833; III. 11:501 and 12:699. G. 25:195; 28:379; 36:379; 37:19. G.M. 57:851.—*R. candidum*, Rehd. (*Asalea candida*, Small) (4). Allied to *R. viscosum*. Shrub, to 6 ft.: lvs. oblong or obovate-oblong, thinly tomentose above, densely white-tomentose and reticulate beneath, $\frac{1}{2}$ –2 in. long; fls. white or pinkish, 1 in. across, after the lvs. Ga.—*R. carneum*, Hutchins. (1). Allied to *R. Veitchianum*. Shrub, to 3 ft.: lvs. elliptic-obovate, glabrous, glaucous and scaly beneath, $2\frac{1}{4}$ – $4\frac{1}{2}$ in. long; fls. campanulate-funnelform, flesh-colored, $3\frac{1}{2}$ in. across; stamens usually 12. Burma. B.M. 8634.—*R. Cartonianum*, DC. (*R. Cartoni*, Hort.). Allied to *R. assaleoides* and said to be of the same parentage as *R. Gownianum*, but lvs. glabrous and fls. more violet, whitish toward the base. B.R. 1449.—*R. Cavronii*, André. Hybrid of *R. formosum* and *R. Veitchii*. Lvs. elliptic: fls. white, usually slightly tinged rose, fragrant, $3\frac{1}{2}$ in. across. R.H. 1885:60.—*R. Championae*, Hook. f. (*Asalea Championae*, Kuntze) (6). Shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, dark green and glabrous above, rusty colored and pilose beneath, ciliate, $2\frac{1}{2}$ –6 in. long; fls. 4–6, wide campanulate-funnelform, with oblong lobes, 3 in. across, rose-colored; stamens 10. Hong-Kong. B.M. 4609. J.F. 2:208.—*R. charitophyllum*, Franch. (1). Allied to *R. racemosum*. Shrub, to 3 ft.: lvs. elliptic, acuminate, lepidote beneath, $2\frac{1}{2}$ – $3\frac{1}{2}$ in. long; fls. 6–12, light pink, spotted, funnelform-campanulate, 2 in. across. S.W. China. G.C. III. 51:291. Gn. 78, p. 304. R.H. 1912, p. 135.—*R. chrysanthum*, Pall. Low shrub, 2 ft. high: lvs. elliptic-oblong, acute, 1–2 in. long, ferruginous beneath: fls. few, slender-pedicelled, broadly campanulate, yellow, $1\frac{1}{2}$ in. across. Siberia, Kamchatka. Hardy.—*R. cilidum*, Hook. f. (1). Small shrub, 2–4 ft.: lvs. elliptic, acuminate, pilose above, ciliate, pale and lepidote beneath, 2 in. long; fls. several, campanulate, pale purple, $1\frac{1}{2}$ in. across. Himalayas. G.C. III. 29:247. Gn. 59, p. 351; 87, p. 266; 75:202. G. 36:658. Var. *roseo-album*, Hook. Fls. larger, white, tinged rose. B.M. 4648. F.S. 8:766. Gt. 16:503. J.F. 3:312.—*R. cilioliz*, Franch. (1). Small shrub: lvs. elliptic-obovate, shortly

acuminate, ciliate, pale and lepidote beneath: fls. 7–10, campanulate, white, 2 in. across. Yunnan. R.H. 1899:36. B.M. 7782. G.W. 8, p. 245.—*R. cinnabarinum*, Hook. f. (1). Slender-branched shrub: lvs. elliptic to elliptic-lanceolate, lepidote beneath, 2–3 in. long; fls. many, nodding, tubular-campanulate, rose-orange or brick-red, $1\frac{1}{2}$ in. long. Himalayas. G. 34:111. Var. *palidum*, Hook. Lvs. glaucous beneath: fls. pale rose, spotted red within. B.M. 4788. Var. *Roylei*, Hook. Lvs. ferruginous beneath: fls. larger, of brighter color. Gn. 44:558. G.C. II. 21:765; III. 12:709.—*R. citrinum*, Hassk. Small shrub: lvs. elliptic-oblong, obtuse, lepidote and pale beneath, $1\frac{1}{2}$ –2 in. long; fls. several, nodding, campanulate, pale yellow, $\frac{3}{4}$ in. long, fragrant. Java. B.M. 4797. Tender.—*R. divianum*, Hook. Hybrid of *R. arboreum* and *R. catawbiense*. Fls. white, blushed and spotted carmine. B.M. 4478.—*R. Collettianum*, Aitch. & Hemsl. Shrub, 10 ft. high: lvs. elliptic-lanceolate, brownish lepidote beneath, $1\frac{1}{2}$ –3 in. long; fls. short-pedicelled, funnelform, white, 1 in. long. Afghanistan. B.M. 7019. G.C. III. 4:297. J.H. III. 51:502.—*R. concinnum*, Hemsl. (*R. coombense*, Hemsl.) (1). Shrub, to 10 ft.: lvs. oval, lepidote beneath, 1–2 in. long; fls. 3–5, purple, campanulate, $1\frac{1}{2}$ in. across. W. China. B.M. 8280, 8620. G.C. III. 53:341.—*R. coombense*, Hemsl.—*R. concinnum*.—*R. crissum*, Franch. Closely allied to *R. Maddenii*, differing in its larger calyx lobes. S. W. China.—*R. Cunninghamii*, Moore. Hybrid of *R. arboreum* var. *cinnamomeum* and *R. maximum* var. *album*. Fls. white, spotted purple. Moore, Gard. Mag. Bot. 1851:121. Not to be confounded with *R. Cunninghamii* White, a variety or hybrid of *R. caucasicum*, which is a dwarf and hardy shrub, much used in Germany as a stock for grafting hardy varieties.—*R. Curtisii*, Moore.—*R. multicolor* var. *Curtisii*.—*R. Dalhousiae*, Hook. f. (1). Straggling shrub, attaining 8 ft., often epiphytal: lvs. elliptic, rusty-lepidote beneath, 4–5 in. long; fls. 3–5, campanulate, yellow, changing to white, fragrant, $\frac{4}{5}$ in. across. Himalayas. B.M. 4718. F.S. 5:466–8. Gn. 28:318; 48, p. 108. G.C. III. 33:338. F.S.R. 3:40. G. 33:579. Remarkable for the large, lily-like fragrant fls. A double-fl. variety is figured in Gn. 13, p. 517. *R. Dalhousiae* hybridum (B.M. 5322) is a hybrid with *R. formosum*, and *R. Dalhousiae* Victorianum is a hybrid with *R. Nuttallii*, see *R. Victorianum*.—*R. Dandii*, Franch. (2). Shrub, to 12 ft.: lvs. oblong-lanceolate, pale green or brownish beneath, glabrous, 4–6 in. long; fls. many, racemose, short-stalked, lilac, spotted purple, broadly campanulate, 7-lobed, $1\frac{1}{2}$ –2 in. across. W. China.—*R. Dandii*, Hemsl. & Wilson (1). Shrub, to 10 ft.: lvs. thinly coriaceous, elliptic to oblong-lanceolate, sparingly lepidote above, densely so beneath and glaucous, 1– $2\frac{1}{2}$ in. long; fls. 1–3, axillary, rosy pink, campanulate-funnelform, 1 in. across. W. China. R.H. 1914, pp. 323, 324. B.M. 8605. Gn. 78, p. 316 (as *R. siderophyllum*).—*R. Dandii*, Hort. Hybrid of *R. javanicum* and *R. retusum*, with tubular orange-red fls. F.M. 20:474. G.Z. 26:145. Not to be confounded with *Asalea Daviesii*, Hort., which is a Ghent *asalea* with white fls.; see p. 2935.—*R. decodrum*, Franch. (*R. lucidum*, Franch. *R. Spooneri*, Hemsl. & Wilson. *R. erubescens*, Hutchins.) (2). Shrub: lvs. oblong, glabrous, glaucous beneath, 4–8 in. long; fls. broadly campanulate, white or pink, to 3 in. across; stamens 16. W. China. G.C. III. 47:120. G. 36:569. R.H. 1914, p. 305. B.M. 8643. *R. Delavayi*, Franch. (2). Tree: lvs. oblong-lanceolate, rufous-tomentose beneath: fls. in large, dense heads, deep red, broadly campanulate, 1 in. across. Yunnan. B.M. 8137.—*R. dilatatum*, Miq. (*Asalea dilatata*, Kuntze) (6). Allied to *R. rhombicum*. Lvs. rhombic-obovate, soon glabrous, 1– $2\frac{1}{2}$ in. long; fls. 1–2, lilac-purple, rotate-campanulate, $1\frac{1}{2}$ –2 in. broad. Japan. S.I.F. 2:61. G.W. 14, p. 270.—*R. discolor*, Franch. (2). Shrub, to 15 ft.: lvs. oblong or oblong-lanceolate, acute at both ends or auriculate at the base, whitish beneath, 6–8 in. long; fls. many, white to rosy pink, funnelform-campanulate, 6-lobed, 3 in. across. Cent. China.—*R. Edgarianum*, Rehd. & Wilson (1). Shrub, to 3 ft., intricately branched: lvs. broadly ovate or oval, obtuse, densely lepidote on both sides, rusty beneath, $\frac{1}{2}$ – $\frac{3}{4}$ in. long; fls. solitary, funnelform, purple, $\frac{3}{4}$ in. across. W. China.—*R. Edgeworthii*, Hook. f. Straggling shrub, often epiphytic: lvs. ovate-lanceolate, blackish green and reticulate above, ferruginous-tomentose below, 3–4 in. long; fls. few, broadly campanulate, white, tinged rose, with broad, waved lobes, $\frac{4}{5}$ in. across. Himalayas. B.M. 4936. F.S. 8:797, 798. Gt. 5:228. H.F. 4:264. R.H. 1913, p. 393.—*R. Eckhautei*, Hort. (*Asalea Eckhautei*, Hort.). Hybrid between *R. indicum* and *R. linearifolium*. Lvs. linear-lanceolate: corolla light pink, semi-double, deeply divided into linear-oblong lobes. Very distinct; as hardy as *R. linearifolium*. R.B. 37:117.—*R. erubescens*, Hutchins.—*R. decorum*.—*R. eximium*, Nutt.—*R. Falconeri* var. *eximium*.—*R. eroniense*, Veitch. Hybrid between *R. ciliatum* and *R. Veitchianum*. Fls. white, faintly tinged rose outside, 3 in. across, very fragrant. G. 6:537; 16:663.—*R. Fäberii*, Hemsl. (2). Shrub, to 18 ft.: lvs. elliptic-oblong, acute, rusty tomentose beneath like the branchlets, 3–6 in. long; fls. white to pale pink, spotted red, broadly campanulate, $1\frac{1}{2}$ in. across; calyx $\frac{3}{4}$ in. long. W. China.—*R. Falconeri*, Hook. f. (2). Shrub or tree, attaining 30 ft.: lvs. elliptic or obovate, rusty-tomentose beneath, 8–10 in. long; fls. many, campanulate, 8–10-lobed, white, with a dark purple blotch within, 1–2 in. across. Himalayas. B.M. 4924. F.S. 5:477–80; 11:1166, 1167. Gt. 19:658. Gn. 48, p. 103; 49, p. 441; 64, p. 377. G.C. III. 20:749. F.S.R. 3, p. 33. G.M. 51:203. G. 19:236; 25:22; 35:65. G.W. 14, p. 270. Remarkable for its very large lvs., sometimes to $1\frac{1}{2}$ ft. long. Var. *eximium*, Hook. Fls. rose-colored and not spotted.—*R. Farquhai*, Franch. (2). Shrub, to 15 ft.: lvs. elliptic, obtuse, subcordate at the base, glabrous, 2–3 in. long; fls. many, white to rosy pink, spotted, broadly campanulate, 6–7-lobed, $1\frac{1}{2}$ –2 in. across; stamens 12–14. Cent. China. G.C. III. 52:4. J.H. F. IV. 1:217.—*R. Farreri*, Tate (*Asalea Farreri*, Koch. A. squamata, Lindl.) (5). Low shrub: lvs. rhombic-ovate, subcoriaceous, 1–2 in. long; fls. pale pink or pale lilac, spotted, $1\frac{1}{2}$ in. across.

Hong-Kong. B.R. 33:3.—*R. fastigiatum*, Franch. (1). Very dwarf, flowering when only 4 in. high; lvs. closely crowded, ovate, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, covered with rusty dots; fls. bright lilac-rose, $\frac{1}{4}$ – $\frac{1}{2}$ in. across. W. China.—*R. fastuosum* var. *flora-plena*, Vase. Houtte. Hybrid of *R. catawbiense* and *R. ponticum*. Fls. lilac-purple, semi-double. F.S. 2:143. Almost hardy.—*R. albidum*, Franch. (2). *R. primum*, Hemsl. (1). Shrub, to 6 ft.: lvs. ovate-oblong, densely lepidote on both surfaces, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 3–5, yellow, rotate-campanulate, $\frac{1}{4}$ in. across; stamens 10. W. China. B.M. 8326. G.C. III. 47:229. J.H.S. 36, p. 55, fig. 78.—*R. floribundum*, Franch. (2). Shrub, to 15 ft. or small tree; lvs. lanceolate, acute at both ends, slightly bullate, white or grayish tomentose beneath, 3–5 in. long; fls. 8–12, rose-colored, $\frac{1}{4}$ – $\frac{1}{2}$ in. across. W. China.—*R. Fordii*, Hemsl. (2). Shrub; lvs. obovate-lanceolate, glabrous, 2–3 in. long; fls. few, white, flushed pinkish outside, $\frac{1}{4}$ in. across. S. China. B.M. 8111.—*R. formosum*, Wall. (R. Gibsonii, Part.). (1). Slender shrub, 8 ft. high; lvs. oblong-ovate, ciliate, pilose above, glaucous and lepidote beneath, 1–2½ in. long; fls. few, funnel-form-campanulate, white, tinged pink, $\frac{1}{4}$ – $\frac{1}{2}$ in. across. Himalaya Mts. B.M. 4457. P.M. 8:217. G.C. III. 17:711. G. 35:157.—*R. Forsterianum*, Hort. Hybrid of *R. Edgeworthii* and *R. Veitchianum*. Fls. large, white. Gn. 76, p. 272. G.W. 3, p. 605. G. 27:251.—*R. Fortunei*, Lindl. Shrub, 12 ft. high, with stout branches, glabrous; lvs. oblong, acute, glaucous beneath, 5–7 in. long; fls. many, broadly campanulate, 7-lobed, rosy lilac; stamens 14. Cent. China. B.M. 5596. Almost hardy. Var. *Houlstonii*, Rehd. & Wilson. Lvs. narrower, smaller; pedicels more glandular.—*R. fragrans*, Maxim. (1). Low shrub; lvs. ovate-elliptic, ferrugineous-lepidote beneath, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 10–15, yellowish white, funnel-form, $\frac{1}{4}$ in. across; stamens 5. E. Siberia.—*R. fragrans*, Lodd., see No. 28. *R. assaleoides*—*R. fragrans*, Burb. Supposed hybrid between *R. ciliatum* and *R. Edgeworthii*. Fls. large, white, faintly tinged rose, fragrant. J.H. III. 57:619; 62:581.—*R. filigens*, Hook. f. (2). Allied to *R. campanulatum*, but smaller; fls. deep blood-red, in a dense head. Himalayas. B.M. 5317. F.S. 8:789. Gn. 67:376.—*R. Gaudinii*, Hort. Hybrid between *R. Griffithianum* and probably *R. ponticum*. Fls. pale flesh-color, changing to white, 4 in. across. G. 32:131; 34:701.—*R. gemmiferum*, Bean. Hybrid between a true rhododendron and an assalea. Dwarf shrub; lvs. deciduous or half-evergreen, oval to elliptic, obtuse or acutish, mucronulate, loosely villous on both sides, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. light carmine, funnel-form-campanulate, tube somewhat longer than the lobes, $\frac{1}{4}$ in. across; stamens 5–10; style exserted, glabrous; ovary villous. Origin unknown. Hardy at the Arnold Arboretum.—*R. Gibsonii*, Part.—*R. formosum*—*R. glaucum*, Hook. f. (1). Small shrub, 3 ft. high; lvs. elliptic-oblong, lepidote, glaucous beneath, 2–4 in. long; fls. 5–8; campanulate, rose-colored, $\frac{1}{4}$ in. across. Himalayas. B.M. 4721. F.S. 7:672. H.F. 1859:241.—*R. Gowenianum*, Sweet. Allied to *R. assaleoides* and supposed to be a cross between a hybrid evergreen rhododendron and *R. nudiflorum* or *R. viscosum*; lvs. oblong-lanceolate, pubescent on both sides while young; fls. purplish pink; calyx-lobes linear.—*R. grande*, Wight (R. argenteum, Hook. f.). (2). Tree, to 40 ft.: lvs. oblong-obovate, acute, glabrous, white beneath, 8–12 in. long; fls. in a dense head, campanulate, 5–8-lobed, rosy at first, changing to white, 2–3 in. across. Himalayas. B.M. 5054. Gn. 48:102; 59, p. 342. F.S. 5:473–6. G.C. II. 17: suppl. June 10; III. 4:158 (suppl.); 27:105; 45:290. R.H. 1888, p. 197. F.S.R. 3, p. 37. Gt. 60:1588. Var. *roseum*, Hook. Fls. rose-colored. B.M. 6948.—*R. Griffithianum*, Wight. Shrub, 8 ft. high, glabrous; lvs. oblong, pale beneath, 6–12 in. long; fls. 4–6, broadly campanulate, white, fragrant, 3 in. across or more. Himalayas. Gt. 15:517; 51, p. 282. G.C. III. 39:243. Var. *Aucklandii*, Hook. Fls. 7 in. across. B.M. 5065. Gn. 20:328. R.H. 1855:81. G.C. II. 22:657; III. 12:697. J.H. III. 57:157. Remarkable for its very large fls.—*R. hematocylum*, Craib—*R. oreodoxa*—*R. Halopendrum*, André. Hybrid of *R. arboreum* and *R. Griffithianum*. Fls. large, bluish. R.H. 1896:428.—*R. Hanceanum*, Hemsl. (1). Shrub, to 3 ft.: lvs. obovate to elliptic-lanceolate, acute, lustrous above, fulvous beneath, minutely scaly, 1–3 in. long; fls. many, in dense heads, yellow, campanulate-funnel-form, $\frac{1}{4}$ in. across; stamens 10. W. China.—*R. Harrisii*, Hort. Hybrid of *R. arboreum* and *R. Thomsonii*. Fls. deep crimson, spotted within.—*R. Harroianum*, Hemsl.—*R. polylepsis*—*R. Hodgeanum*, Hook. f. Shrub or small tree, attaining 20 ft.: lvs. narrowly obovate-oblong, whitish or brownish tomentose beneath, 8–18 in. long; fls. in a dense head, broadly campanulate, pale purple, 2 in. across. Himalayas. B.M. 5552. R.H. 1855:421; 1896:191. Gn. 73, p. 588.—*R. Hookeri*, Nutt. (2). Shrub, 14 ft. high; lvs. oblong-oval, glabrous, glaucous below and sparingly chafy on the veins; fls. campanulate, deep crimson, 1–1½ in. across; calyx cup-shaped. Himalayas. B.M. 4926.—*R. Houlstonii*, Hemsl. & Wilson.—*R. Fortunei* var. *Houlstonii*—*R. Hunnebellianum*, Rehd. & Wilson. (2). Shrub, to 15 ft.: lvs. oblanceolate or oblong-lanceolate, acuminate, glabrous above, white-tomentose beneath, 3–4½ in. long; fls. many, white, spotted, broadly campanulate, 2 in. across. W. China.—*R. hypoleucum*, Hemsl. (2). Lvs. elliptic, acute, 2–3 in. long; corolla snow-white; segms. notched. Cent. China. B.M. 8649.—*R. imbricatum*, Hort. Apparently a hybrid of *R. ponticum* with a hardy species of the same group. Dwarf, very compact shrub; lvs. crowded, oblong, obtuse, glabrous, lustrous, convex and somewhat bullate above, 1½–2½ in. long; pedicels puberulous; fls. pale lilac-purple, 2 in. across; style and the sometimes petaloid stamens short; ovary glabrous. Origin unknown. Hardy at the Arnold Arboretum.—*R. insignis*, Hemsl. & Wilson. (2). Shrub, to 18 ft.: lvs. lanceolate-oblong, acute at both ends, lustrous above, grayish tomentose beneath, 3½–5 in. long; fls. many, pink to white, broadly campanulate, 1½–2 in. across; stamens 14 or more. W. China.—*R. intermedium*, Tausch. Hybrid between *R. ferrugineum* and *R. hirsutum* and intermediate between the two. Has been found occasionally with the parents.—*R. intricatum*, Franch. (1). Shrub, to 3 ft.: lvs. elliptic or ovate, obtuse, densely lepidote on both

sides, silvery beneath, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 3–5, rosy purple, funnel-form, $\frac{1}{4}$ in. across. W. China. B.M. 8163. G.C. III. 41:262. Gn. 78:190, 294. R.B. 35, p. 103. J.H.S. 33, p. 49, fig. 51. J.H. III. 54:345. M.D.G. 1909:145.—*R. irroratum*, Franch. Shrub, several feet high, glabrous; lvs. oblong to oblong-lanceolate, pale beneath, 3–4 in. long; fls. many, funnel-form-campanulate, $\frac{1}{4}$ in. long, white, tinged pink. Yunnan. B.M. 7361. G.C. III. 49:350.—*R. Jacksonii*, Hort. (G. 28:183) is said to be the same as *R. venustum*—*R. jacksonii*, Blume (1). Large shrub, glabrous; lvs. elliptic to oblong, acute, minutely lepidote beneath, 3–6 in. long; fls. many, funnel-form, orange-yellow to brick-red, 2 in. across. Winter. Malayan Archipelago and Penin. B.M. 4336. F.S. 3:293, 294; 6:576. P.M. 15:17. Var. *tubiflorum*, Hook. Lvs. smaller; fls. smaller and with longer tube, salmon-pink. B.M. 6850.—*R. Jekinsii*, Nutt.—*R. Maddenii*—*R. kamtschaticum*, Pall. (*Asalea kamtschatica*, Kuntze). Belongs to the section *Therorodion*, characterized by the fls. being borne at the end of the young branchlets. Prostrate undergrowth; lvs. deciduous, obovate or spatulate, obtuse, ciliate, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 2–3, in terminal racemes, rotate-campanulate, $\frac{1}{4}$ in. across, carmine-purple, spotted; stamens 10; ovary pilose. E. Siberia, N. Japan and Alaska. B.M. 8210. Gt. 36:1260. G.C. III. 44:128. G.W. 13, p. 554. Hardy, but difficult to cult.—*R. Kewdrickii*, Nutt. (2). Large shrub; lvs. lanceolate, acuminate, glabrous, pale beneath, 4–7 in. long; fls. many, campanulate, bright scarlet, 2 in. across. Himalayas. Var. *latifolium*, Hook. Lvs. broader, oblong-lanceolate, glandular pubescent beneath when young. B.M. 5129.—*R. Kesselringii*, Wolf. Hybrid between *R. ponticum* and *R. Smirnovii*. Low shrub; lvs. soon glabrous beneath; fls. rosy purple with darker margin.—*R. kewense*, W. Wats. Hybrid of *R. Griffithianum* and *R. Hookeri*. Fls. large, in loose heads, crimson, pink or almost white. Gn. 42:474; 52:284; 76, p. 319. G.C. III. 23:291. G.M. 44:356; 50:211.—*R. Khasii*, Nutt. Belongs to the section *Keyia* characterized by the tubular corolla with short erect lobes. Shrub, 2–6 ft. high, with ferrugineous branches; lvs. elliptic-lanceolate, glabrous, pale and sparingly scaly beneath, 3–4 in. long; fls. many, tubular, with short erect lobes, brick-red, 1 in. long. July. Himalayas. B.M. 4875. F.S. 11:1110. Gt. 12:415. Gn. 48, p. 106.—*R. Kotchy*, Simonkai (R. myrtifolium, Schott & Kotchy, not Lodd.). (1). Low shrub; lvs. oblong-obovate, obtuse, mucronulate, shining above, ferrugineous-lepidote beneath, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. few, tubular-funnel-form, with the tube outside pubescent, inside villous, carmine, $\frac{1}{4}$ in. long; style shorter than ovary. July. Carpathian Mts. Gn. 56, p. 159. R.F.G. 17:1157, figs. 2, 3.—*R. Ladecum*, Franch. (2). Tree, to 30 ft.: lvs. cordate, elliptic-ovate, brownish tomentulose beneath, 5–10 in. long; fls. in dense heads, broadly campanulate, 6-lobed, white, 1 in. across. Yunnan. B.M. 8372. R.H. 1912, pp. 375, 376.—*R. landrum*, Hook. f. (2). Shrub or small tree; lvs. obovate to obovate-oblong, with tawny woolly tomentum beneath, and also above when young, 3–5 in. long; fls. 6–10, broadly campanulate, yellow, spotted red within, 2–2½ in. across. Himalayas. F.S. 7:684. R.H. 1855:161. Almost hardy.—*R. lanceifolium*, Moench—*R. ponticum*—*R. lanceifolium*, Hook. f.—*R. larbatum*—*R. lappaceum*, Wahl. (1). Depressed shrub; lvs. oval or oblong, obtuse, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 3–6, broadly campanulate, purple, $\frac{1}{4}$ in. across; stamens 5–8. July. Mountains of N. Amer., N. Eu., N. Asia. B.M. 3106. M.D.G. 1910:136. Hardy.—*R. lepidotum*, Wall. (R. elegans, Hook. f.). (1). Slender shrub, 4 ft. high; lvs. obovate to lanceolate, glaucous-green, lepidote beneath, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; fls. 1–3, sometimes many, slender-pedicelled, broadly campanulate, yellow or dull purple, spotted within, $\frac{1}{4}$ in. across; stamens usually 8. Himalayas. B.M. 4657. Gn. 15:182. G.C. II. 22:297. J.F. 4:343. Var. *chordanthum*, Hook. (R. salignum, Hook. f.). Fls. greenish or pale yellow, spotted greenish; lvs. narrow. Var. *obovatum*, Hook. Fls. dark purple, larger; lvs. obovate.—*R. linearifolium*, Sieb. & Zucc. (*Asalea linearifolia*, Hook.). (6). Allied to *R. ledifolium*. Lvs. linear-lanceolate; corolla pink, deeply divided into 5 linear-lanceolate segms. Japan. B.M. 5769. G.M. 36:104.—*R. Lobbii*, Veitch (1). Slender shrub, allied to *R. malayanum*; lvs. elliptic-oblong; fls. almost salver-shaped, with slender, curved tube, bright crimson. Winter. Borneo. The *R. Lobbianum*, Moore (F.M. 1:10), belongs to *R. Brookianum*—*R. Loderi*, Hort. Hybrid between *R. Fortunei* and *R. Griffithianum*. Fls. white to soft rose, 6-lobed, 5–6 in. across, fragrant. G.C. III. 50:30; 51:360. Not to be confused with *Loderi* hybrid which is a cross of unknown origin, apparently also of *R. Griffithianum*.—*R. longesquamatum*, Schneid. (R. Bretti, Hemsl. (2). Shrub, to 15 ft.: scales of lf-buds persistent, elongated; lvs. obovate-oblong, acute, rounded at the base, glabrous beneath, except the villous midrib and petiole, 2½–5 in. long; fls. 6–15, rose pink, campanulate, 2 in. across. W. China.—*R. longistylum*, Rehd. & Wilson. (1). Allied to *R. micranthum*. Shrub, to 6 ft.: lvs. oblanceolate or oblong-lanceolate, sparingly lepidote beneath, 1–2½ in. long; fls. 10 or more, white, funnel-form-campanulate, $\frac{1}{4}$ in. across; style exserted, 1 in. long. W. China. R.H. 1914, p. 232, 233.—*R. lucidum*, Franch.—*R. decorum*—*R. Lucibei*, V. Wats. Hybrid of *R. Fortunei* and *R. Thomsonii*. Fls. large, rose-colored to crimson. Gn. 66, p. 392. G. 26:528.—*R. luteo-roseum*, Franch. (1). Allied to *R. racemosum*. Lvs. lanceolate or ovate-lanceolate long-acuminate, sparingly lepidote, light green beneath; fls. 1– from axillary heads, 1 in. across, yellow; stamens 10, exserted. W. China. R.H. 1914:324.—*R. macrocarpos*, Griff.—*R. Dalhousiae*—*R. macrosepalum*, Maxim. (*Asalea macrosepalis*, Kuntze). (6) Shrub, to 2 ft.: branchlets villous; lvs. deciduous or subsistent elliptic, 1–2 in. long; fls. umbellate, rose-lilac, spotted, 2 in. across. Sepals lanceolate, long, glandular-pubescent. Japan. Gt. 19:66. *Asalea dianthiflora*, Carr. (R.H. 1891:60) is possibly a double-fl. form of this species.—*R. macrostemon*, Maxim. (6). Low half-evergreen shrub; lvs. oblong-elliptic, pubescent, about ½ in. long; fls. pinkish, $\frac{1}{4}$ – $\frac{1}{2}$ in. across; stamens twice as long as corolla. Japan.—*R. Maddenii*, Hook. f. (1). Shrub, to 8 ft.: lvs. short-stalked elliptic-lanceolate, ferrugineous-lepidote beneath, 4–7 in. long; f

3, funnel-shaped, white, faintly blushed, to 4 in. across; stamens 18-20. Himalayas. B.M. 4805. F.S. 9:912. R.H. 1855:301. I.H. 4:140. Gt. 9:277 (as R. Jenkinsii). H.F. 7:296. Var. *obtusifolium*, Hutchins. Lvs. rounded at both ends; calyx-lobes longer. Manipur. B.M. 8212. —*R. malaydnum*, Jack. (1). Small shrub or small tree: lvs. elliptic-lanceolate, red-brown-lepidote beneath, 3-4 in. long; fls. few, salver-shaped, dull scarlet, $\frac{1}{4}$ in. long. Winter. Malacca, Java. B.M. 6045. —*R. Manglesii*, Hort. Hybrid of *R. Griffithianum* and *R. hybridum album elegans*. Fls. large, white, spotted. G.C. II. 24:49; III. 12:787. Gn. 66, p. 393; 69, p. 329. F.S.R. 3, p. 39. G. 13:101. —*R. Moriesii*, Hemsl. & Wilson (6). Allied to *R. rhombicum*. Shrub, to 8 ft.: lvs. oval, acute, silky-pubescent on the midrib beneath, 2-3 in. long; fls. 1-3, rose-pink, broadly campanulate, $1\frac{1}{2}$ in. across; stamens 10. Cent. China. B.M. 8206. —*R. modestum*, Hook. f. (1). Small shrub, glabrous: lvs. elliptic-oblong, greenish yellow and lepidote beneath, 2-3 in. long; fls. 6-10, broadly funnelform, pale pink, spotted red within, $1\frac{1}{2}$ in. across. Himalayas. B.M. 7086. —*R. Moorei*, Wats. Hybrid between *R. arboreum* and *R. campanulatum*. Fls. large, white spotted purplish: lvs. with buff-colored tomentum beneath. —*R. Morelianum*, Lem. Hybrid between *R. catabiense* and probably *R. ponticum*. Fls. lilac-violet, with a whitish blotch spotted with yellow. H.U. 4:1. —*R. moumainense*, Hook. (2). Shrub: lvs. elliptic-lanceolate, glabrous, 4-5 in. long; fls. many, white, funnelform-campanulate, $1\frac{1}{2}$ -2 in. across. Himalayas. B.M. 4904. —*R. moupinense*, Franch. (1). Shrub, to 4 ft., sometimes epiphytic: lvs. ovate to ovate-oblong, obtuse, rusty lepidote beneath, 1-1 $\frac{1}{2}$ in. long; fls. solitary, white, spotted purple, $1\frac{1}{2}$ in. across. W. China. B.M. 8598. G.C. III. 55:133. R.H. 1914, p. 155. Gn. 78, p. 96. —*R. multicolor*, Miq. Small, slender shrub: lvs. whorled, narrowly elliptic-lanceolate, 2-3 in. long; fls. few, funnelform-campanulate, 1 in. long, yellow or dark red. Winter. Sumatra. B.M. 6769. Tender. The red-fld. form is distinguished as var. *Curtisii*, Hort. Gn. 56, p. 62. F. 1884:113. G.Z. 30:73. —*R. myrsinifolium*, Schott & Kotschy, not Lodd. = *R. Kotschyi*. —*R. nigro-punctatum*, Hort., not Franch. = *R. nitidulum* var. *nubigenum*. —*R. nipponicum*, Matsum. (5). Shrub: lvs. deciduous, elliptic-obovate, obtuse, strigose on the veins beneath and sparingly strigose above, $2\frac{1}{2}$ -7 in. long; fls. in dense heads, white, subcampanulate, $\frac{1}{2}$ in. long; stamens 10, about as long as the corolla; style glabrous; ovary villous. Japan. —*R. nitidulum*, Rehd. & Wilson (1). Shrub, 2-4 ft.: lvs. oval or ovate, densely lepidote on both sides, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. 1-2, violet-purple, funnelform-rotate, 1 in. across. W. China. Var. *nubigenum*, Rehd. & Wilson (1). *R. nigro-punctatum*, Hort., not Bur. & Franch.). One-half to 1 ft., densely branched: lvs. $\frac{1}{4}$ - $\frac{1}{2}$ in. long, brown beneath; fls. rosy lilac, $\frac{1}{2}$ in. across; calyx large, usually colored. W. China. B.M. 8529. —*R. nigrum*, Hook. f. (2). Small shrub, allied to *R. campanulatum*: lvs. obovate-oblong, whitish tomentose all over at first, later glabrous above, 3-6 in. long; fls. broadly campanulate, light rose-lilac at the base, within with 5 purple spots, 2 in. across. Himalayas. B.M. 4730. J.F. 4:421. Var. *fulvum*, Hook. Lvs. light brownish tomentose: fls. deep purple-lilac. B.M. 6827. —*R. Noblednum*, Lindl. Hybrid of *R. arboreum* and *R. caucasicum*. Fls. rosy crimson. B.R. 1820. Gn. 77, p. 30. —*R. Nuttallii*, Booth (1). Shrub, sometimes epiphytic or tree 30 ft. high; lvs. elliptic-oblong, reticulate, pale and lepidote beneath, 6-12 in. long; fls. 4-12, broad funnelform, white, tinged yellow within, fragrant, to 6 in. across; calyx large. Himalayas. B.M. 5146. F.S. 13:1326, 1327. Gn. 54, p. 106; 79, p. 290. G.C. II. 20:49; III. 12:436 (suppl.). R.B. 31:145. G.Z. 2:96. R.H. 1913:452. —*R. obovatum*, Hook. f. = *R. lepidotum* var. *obovatum*. —*R. orbiculare*, Decne. (*R. rotundifolium*, David) (2). Lvs. nearly orbicular, 2-4 in. long, usually not so broad as long: fls. 8-10; corolla 2 in. across, rosy red. W. China. —*R. oreodora*, Franch. (*R. haematocichium*, Craib). (2). Shrub, to 10 ft.: branchlets soon glabrous: lvs. elliptic-lanceolate, glabrous, yellowish green beneath, $2\frac{1}{2}$ -3 $\frac{1}{2}$ in. long; fls. 10-12, rose-pink, campanulate, 7-8-lobed, $\frac{1}{4}$ in. across. W. China. B.M. 8518. —*R. odatum*, Franch. (*Asalea ovata*, Lindl. A. *myrsinifolia*, Champ.) (3). Lvs. ovate or elliptic-ovate, glabrous, 1-2 in. long; fls. rotate, pink or nearly white, $1\frac{1}{2}$ in. across; stamens 5. Cent. China. B.M. 5064. J.H.S. 1847:126. —*R. pachytrichum*, Franch. (2). Shrub, to 18 ft.: lvs. narrow, oblong-lanceolate, acuminate, rounded at base, rufously hairy on the midrib beneath and on the petiole, $2\frac{1}{2}$ -5 in. long; fls. 10-15, campanulate, $1\frac{1}{2}$ in. across, pale pink to white; stamens 10. W. China. —*R. parvifolium*, Adams (1). Shrub allied to *R. lapponicum*, but larger: 3 ft. high; lvs. not revolute at the margin, larger: fls. larger, purple or white; style much longer than stamens. Siberia, Kamchatka, Japan. Gt. 26:904. G.C. III. 39:164, 165. —*R. pendulum*, Hook. f. (2). Slender shrub, 4 ft. high: lvs. elliptic to oblong, acute, ferruginous-tomentose beneath, $1\frac{1}{2}$ -2 in. long; fls. few, broadly campanulate, white, about 1 in. across. Himalayas. F.S. 7:662. G.C. II. 17:429. —*R. pentaphyllum*, Maxim. = *R. quinquefolium*. —*R. pitiosporifolium*, Hemsl. = *R. stamineum*. —*R. polysepis*, Franch. (*R. Harrovianum*, Hemsl.). (1). Shrub, to 10 ft.: lvs. lanceolate, acute at both ends, glabrous above, densely lepidote beneath, $1\frac{1}{2}$ -3 in. long; fls. 3-5, purple or lilac-purple, $1\frac{1}{2}$ in. across; stamens 10, exserted. W. China. B.M. 8309. R.H. 1914:324. —*R. primulinum*, Hemsl. = *R. flavidum*. —*R. Przewalskii*, Maxim. (2). Allied to *R. brachycarpum*, but lvs. glabrous and pale green beneath: fls. white, spotted purple within. China. Hardy. —*R. pulcherrimum*, Lindl. Hybrid of *R. arboreum* and *R. caucasicum*. Fls. pink, paler in center, spotted. B.R. 1820. —*R. quinquefolium*, Bisset & Moore (6). Deciduous shrub: lvs. 4-5, subverticillate at the end of the branchlets, short-petioled, rhombic, acutish or obtuse, ciliate and sparingly strigose-pubescent, 1-1 $\frac{1}{2}$ in. long; fls. 1-2, campanulate, 3 in. across; stamens 10. Japan. Var. *roseum*, Rehd. Fls. pink; possibly identical with *R. pentaphyllum*, Maxim. —*R. retusum*, Bennett (1). Shrub, 2 ft. high: lvs. obovate to obovate-oblong, glabrous, lepidote beneath, 2-2 $\frac{1}{2}$ in. long; fls. 6-9, tubular-funnel-shaped, bright scarlet, to

$1\frac{1}{2}$ in. long. Java. B.M. 4859. F.S. 10:1044. I.H. 2:70. Tender. —*R. Rietzi*, Hemsl. & Wilson (2). Shrub, to 18 ft.: lvs. lanceolate or oblong-lanceolate, acute at both ends, glabrous and grayish below, 4-6 in. long; fls. about 10, white, 2 in. across. W. China. —*R. robustissimum*, Lindl. = *R. fastuosum*. —*R. Rollissonii*, Paxt. (2). Small tree, 30 ft. high, allied to *R. arboreum* and probably variety: lvs. oblong, wrinkled above, tawny-tomentose beneath: fls. in a dense head, campanulate, deep blood-red. Ceylon. B.R. 29:25. —*R. rotundifolium*, David = *R. orbiculare*. —*R. Roylei*, Leroy. Hybrid of *R. arboreum* and *R. dahuricum*. Fls. rich crimson. R.H. 1868:190. —*R. Roylei*, Hook. = *R. cinnabarinum* var. *Roylei*. —*R. rubiginosum*, Franch. (1). Rigid shrub, 3 ft. high: lvs. oval to oblong-lanceolate, densely ferruginous-lepidote beneath, 2-3 in. long; fls. few, broadly funnelform, bright rose-red, $1\frac{1}{2}$ in. across. Yunnan. B.M. 7621. —*R. rufescens*, Franch. (1). Shrub, to 4 ft.: lvs. oval, brown-tomentose beneath, $\frac{1}{4}$ -1 in. long; fls. white, about $\frac{1}{2}$ in. across. W. China. —*R. Russellianum*, Sweet. Hybrid of *R. arboreum* and *R. catabiense*. Lvs. tomentose beneath: fls. rosy crimson. —*R. salignum*, Hook. = *R. lepidotum* var. *chloranthum*. —*R. Sargentianum*, Rehd. & Wilson. (1). Alpine shrub, 1-2 ft.: lvs. oval, obtuse, and mucronate, rusty-tomentose beneath, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. 6-12, funnelform, whitish or pale yellow, $\frac{1}{2}$ in. across; stamens 5; calyx large. W. China. —*R. scaberrimum*, Franch. (1). Small rigid shrub, hispid: lvs. oblong-lanceolate, ciliate, hispid above, pale and lepidote beneath, $2\frac{1}{2}$ -3 $\frac{1}{2}$ in. long; several few-fld. clusters at the end of branches: fls. broadly campanulate, bluish, $1\frac{1}{2}$ in. across. Yunnan. B.M. 7159. —*R. Sedrizei*, Rehd. & Wilson. (1). Shrub, to 15 ft.: lvs. oblanceolate to oblong-lanceolate, acuminate, glaucous and lepidote beneath, $1\frac{1}{2}$ -3 in. long; fls. 4-8, funnelform-campanulate, $1\frac{1}{2}$ in. across, white or pale purple. W. China. G.C. III. 55:334. —*R. semibarbatum*, Maxim. (*Asalea semibarbatum*, Kuntze) (3). Allied to *R. albidum*. Lvs. elliptic, crenately ciliate, setose beneath: fls. greenish yellow, spotted purple, $\frac{1}{4}$ - $\frac{1}{2}$ in. broad. Japan. Gt. 19:606. —*A. serpyllifolium*, Miq. (*Asalea serpyllifolia*, Gray) (6). Low, rigid shrub: lvs. deciduous, obovate, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. single, rosy red, $\frac{1}{4}$ - $\frac{1}{2}$ in. broad. Japan. B.M. 7503. —*R. Sesterdium*, Hort. Hybrid of *R. Edgeworthii* and *R. formosum*. Fls. large, white. G. 17:383; 20:701. R.H. 1906, p. 488. —*R. setosum*, D. Don (1). Shrub, about 1 ft.: branchlets setose: lvs. elliptic-obovate or oblong, lepidote on both sides, setosely ciliate, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. rosy purple, nearly rotate, deeply divided, about 1 in. across. E. Himalayas. B.M. 8523. —*R. Shikong*, Hemsl. & Wilson (2). Evergreen shrub, 4-6 ft. high: lvs. oval or ovate, $2\frac{1}{4}$ -4 in. long; quite glabrous; petiole $\frac{1}{4}$ -1 in. long; corolla broadly campanulate, 7-lobed, $1\frac{1}{2}$ in. across, pink. W. China. —*R. Shepherdii*, Nutt. (2). Shrub: lvs. oblong-lanceolate, glabrous, pale beneath, 3-4 in. long; fls. in a dense head, campanulate, deep scarlet, 2 in. across. Himalayas. B.M. 5125. —*R. Shilonii*, Hort. Hybrid of *R. barbatum* and *R. Thomsonii*. Fls. dull red. Gn. 57, p. 261. —*R. siderophyllum*, Hort., not Franch. = *R. Davidsonianum*. —*R. Smithii*, Sweet. Hybrid of *R. arboreum* and *R. ponticum*. Fls. rose-purple. Var. *albium*, Hort. Fls. white, early. —*R. Smithii*, Nutt. = *R. barbatum* var. *Smithii*. —*R. Smithii atrovum*, Hort. See under No. 28, *R. asaleoides*. —*R. Souliei*, Franch. (2). Shrub, to 10 ft.: lvs. broadly ovate, cordate, mucronate, glabrous, whitish beneath, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; fls. 5-7, rose-pink, broadly campanulate, with short rounded lobes. W. China. B.M. 8622. G.C. III. 45:380. Gn. 73, p. 278. G.M. 52:416. J.H.S. 35, p. 137, fig. 89. —*R. spinuliferum*, Franch. (1). Shrub, to 8 ft.: branchlets finely gray, pilose and hispid: lvs. lanceolate, acute at both ends, wrinkled above, lepidote and slightly pilose beneath, 1-1 $\frac{1}{2}$ in. long; fls. usually 4, red, tubular, with upright lobes, 1 in. long; stamens exserted. S. W. China. B.M. 8408. R.H. 1910:404. —*R. Spomeri*, Hemsl. & Wilson = *R. decorum*. —*R. stamineum*, Franch. (*R. pitiosporifolium*, Hemsl.). (3). Shrub, to 20 ft.: lvs. obovate-oblong to elliptic-oblong, acuminate, glabrous, $2\frac{1}{4}$ -4 in. long; fls. many, white to pink, spotted yellow, funnelform with long narrow tube, 1-1 $\frac{1}{2}$ in. long, fragrant. Cent. and W. China. B.M. 8601. —*R. strigulosum*, Franch. (2). Shrub, to 15 ft.: branchlets and petioles setose; lvs. oblong-lanceolate, subcordate at the base, with crustaceous white tomentum and setose hairs beneath, 4-6 in. long; fls. many, white to purple, funnelform-campanulate, $1\frac{1}{2}$ in. across. W. China. —*R. sublancoletum*, Miq. (*Asalea sublancoletum*, Kuntze) (6). Allied to *R. poukhanense*. Lvs. narrow-elliptic to oblanceolate, acute at both ends, with 5-9 pairs of veins, strigose on the veins on both sides, $1\frac{1}{4}$ -2 in. long; fls. 1-3; sepals oblong obtuse, strigose and glandular-ciliate; corolla funnelform, rosy red to crimson, 3 in. across; stamens 10. S. Japan. B.M. 8478. G.C. III. 49:342. J.H.S. 37, p. 131, fig. 115. —*R. taliense*, Franch. (2). Shrub, to 10 ft.: lvs. ovate-oblong, subcordate, short-acuminate, fulvous-tomentose beneath, $2\frac{1}{4}$ -5 in. long; fls. 3-12, white to pink, funnelform-campanulate, 1 in. across; ovary glabrous. W. China. —*R. Teymannii*, Miq. (1). Closely allied to *R. javanicum*: lvs. more shining, not lepidote beneath: fls. somewhat smaller, pale lemon-yellow. Sumatra, Java. —*R. Thomsonii*, Hook. f. (2). Shrub, 15 ft. high: lvs. obovate-oval, glabrous, glaucous beneath, 2-3 in. long; fls. 6-8, campanulate, deep blood-red, 2 in. across; calyx large. Himalayas. B.M. 4997. R.H. 1855:121. F.S. 7:688-90. G. 28:247; 36:535. —*R. trichostomum*, Franch. (1). Shrub, to 6 ft.: lvs. ovate-oblong to elliptic-lanceolate, rusty-tomentose beneath, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. 10-15, rose-pink, tubular-funnelform, $\frac{1}{2}$ in. across, mouth hairy; stamens included. W. China. —*R. triflorum*, Hook. f. (1). Shrub, 6 ft. high: lvs. ovate-lanceolate, glaucous beneath and with ferruginous scales, 2-3 in. long; fls. mostly 3, slender-pedicelled, broadly campanulate, greenish yellow, 2 in. across. Himalayas. F.S. 7:673. G.C. II. 18:45. J.H. III. 30:193. G. 26:282. —*R. Tachonokii*, Maxim. (*Asalea Tachonokii*, Kuntze) (6). Low shrub: lvs. elliptic, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; fls. 2-4, white, $\frac{1}{2}$ in. broad. Japan. —*R. tubiflorum*, DC. = *R. malayanum*. —*R. Ungeri*, Trautv. (2). Closely allied to *R. Smirnovii*, but fls. white: calyx

with longer, narrower lobes. July. Caucasus. Gt. 35:1226. B.M. 8332.—*R. Veitchianum*, Hook. (1). Shrub, 6 ft. high: lvs. obovate, glaucous beneath and with scattered ferruginous scales, 3-4 in. long: fls. 3-5, broadly funnelform, with crisped lobes, pure white, 5 in. across. Himalayas. B.M. 4992. F.S. 14:1416. A.F. 11:145. Gn. 51, p. 178. G.M. 45:476. G. 19:664, 26:71. Var. *laevigatum*, Hort. Lobes of corolla only slightly crisped.—*R. sensitum*, Sweet. Hybrid of *R. arboreum* and *R. caucasicum*. Fls. rich pink.—*R. Victorianum*, Hort. (*R. Dalhousiae* var. *Victorianum*, Guilmoit). Hybrid between *R. Dalhousiae* and *R. Nuttallii*. Fls. very large, to 5 in. long and to 3½ in. wide, white, with yellow center: lvs. glaucous beneath. F.S. 23:2466. R.B. 13:49. G.C. III. 51:406. G. 35:311.—*R. villosum*, Hemsl. & Wilson. (1). Evergreen shrub, to 18 ft., bristly: lvs. ovate or oblong, pointed, 2-3½ in. long: fls. in clusters of 3 or more; corolla with funnel-shaped tube and a 5-lobed limb, purple. W. China.—*R. molleum*, Rehd. & Wilson (1). To 4 ft., but sometimes dwarf: fls. similar to those of *R. intricatum*, but narrower, yellowish or brownish lepidote beneath with scattered dark scales, revolute at margin: fls. 1-3, terminal, subsessile; corolla violet-purple, over 1 in. across. W. China.—*R. rigidum*, Hook. f. (1). Slender shrub: lvs. oblong-lanceolate, glaucous and scaly beneath: fls. 1-2, from axillary buds at the end of branches, funnelform, rose-colored, 1½ in. across. Himalayas. B.M. 5060. F.S. 14:1408. Var. *album*, Hort. Fls. white. R.H. 1866:251.—*R. Wasonii*, Hemsl. & Wilson (2). Shrub, to 6 ft.: lvs. ovate to ovate-lanceolate, acute, brown-tomentose beneath, 2-3 in. long: fls. about 6, rose-pink to white, campanulate, 1½-2 in. across. W. China.—*R. Watsonii*, Hemsl. & Wilson (2). Shrub or small tree, to 30 ft.: lvs. ovate to ovate-lanceolate, slightly wrinkled above, brownish tomentose beneath, 2-3 in. long: fls. 6, funnelform-campanulate, 2 in. across, pink or creamy white. W. China.—*R. Websterianum*, Rehd. & Wilson (1). Shrub, to 3 ft.: lvs. ovate or elliptic, obtuse, lepidote above, densely whitish lepidote beneath, ½-1½ in. long: fls. 1-3, funnelform, rosy purple, 1 in. across. W. China.—*R. Wightii*, Hook. f. (2). Shrub, attaining 14 ft.: lvs. ovate-oblong, cinnamomeous-tomentose beneath, 6-8 in. long: fls. many, campanulate, yellow, spotted red within, 2½ in. across. Himalayas. F.S. 8:792. 793. B.M. 8492. G.C. III. 50:269.—*R. Williamsianum*, Rehd. & Wilson (2). Branchlets slender, almost twiggy, diffusely branching: lvs. ovate or roundish-ovate, usually subcordate, glabrous, ¾-1½ in. long: fls. 3-5 in a terminal cluster; corolla pale rose. W. China.—*R. Willmotiae*, Hort.—*R. Hanceanum*—*R. Wilsonae*, Hemsl. & Wilson. (3). An evergreen shrub, to 6 or 7 ft.: lvs. narrowly oval or oval-lanceolate, 2¼-4¼ in. long: fls. solitary, axillary, slightly fragrant; corolla pale purple, about 2 in. across. Cent. China.—*R. Wilsonii*, Hemsl. & Wilson. (2). Evergreen shrub, to 8 ft. high: young shoots, underside of lvs. and ovary densely clothed with pale brown wool: lvs. deeply wrinkled, obovate, 2-3½ in. long: fls. in clusters of 6 or more; corolla pink. W. China.

ALFRED REHDER.

RHODOLEIA (Greek, *rose* and *smooth*; alluding to rose-like fls. and smooth st.). *Hamamelidaceae*. Small tender trees: lvs. evergreen, glabrous, long-stalked: fls. about 5 together in a compact head, having the appearance of a single fl. surrounded by bracts, hermaphrodite; petals of each fl. turned toward the circum. of the head; stamens 7-10; ovary of 2 carpels united at base: caps. several-seeded.—Two species, one from China and the other from Java and Sumatra.

Championii, Hook. A tender tree: lvs. shining, coriaceous, usually ovate, 4-5 in. long; petioles 1½-2 in. long: fl.-heads resembling a semi-double camellia, 1½ in. across, bright pink, each head surrounded by several rows of imbricate bracts; petals 15-20 to each fl.-head. China. B.M. 4509. J.F. 1:4.—Formerly in cult. in S. Calif.

F. W. BARCLAY.

RHODOMYRTUS (Greek, *rose-myrtle*, from the rose-colored flowers). *Myrtaceae*. Tender trees and shrubs, one of which, *R. tomentosa*, is of slight economic importance in southern Asia, where it is native, and which is grown to a limited extent in California and Florida.

Leaves opposite, 5- or 3-nerved: fls. rather large, axillary; calyx-tube turbinate, the lobes persistent; petals 5 or 4; stamens numerous, free, in many series; berry globose or ovoid, with few to many seeds.—Species about 5. The genus differs from *Myrtus* in having 1-3 locules in the ovary with 2 rows of ovules in each, the locules frequently with spurious partitions or divided into numerous 1-ovulate superposed cells; while the lvs., in place of being pinnately veined, have 3-5 nerves. *R. tomentosa* is indigenous to India, Ceylon, Malaya, and S. China. The other species are Australian and not cult.

tomentosa, Wight (*Myrtus tomentosa*, Ait.). **DOWNY MYRTLE**. **HILL-GOOSEBERRY**. Small shrub, up to 5 ft.,

the young branchlets tomentose: lvs. elliptic or obovate, obtuse, 1-2½ in. long, hoary below; petioles short: fls. 1-3 on slender peduncles about half the length of the lvs., rose-pink, ½-¾ in. broad; calyx tomentose, 5-cleft, the lobes unequal; petals downy outside, shortly clawed: berry globose, ½ in. broad, dull purple, 3-celled, with numerous small compressed seeds in each cell. B.M. 250.—This plant seems to be best known in S. India, where it occurs commonly in the mountains. It is said by Macmillan to succeed in Ceylon only at high elevations. In S. China the fr. is sometimes offered in the markets. While intro. to Fla. some years ago, it is not generally grown in that state, although it is an excellent garden plant of ornamental as well as economic value. According to Reasoner it grows as far north as Putnam County; it succeeds remarkably at Bradentown, where it has almost become naturalized in one or two spots, and it is successfully grown at Miami. In Calif. it has fruited in a few gardens. It does not stand very much frost, although it is harder than some of the strictly tropical frs. The guava-like fr. is about the size of a gooseberry, of a dull purple color, with numerous small seeds embedded in soft pulp of sweet pleasant flavor, somewhat suggesting the raspberry but rather lacking in character. According to Simpson, it makes excellent pies, if picked before fully ripe. The season in Fla. is early summer, at which time the plants are laden with fr. The fls., which appear in spring, resemble small single roses, and are of unusually attractive appearance, making the plant highly ornamental while in bloom. Frequently the frs. ripen over a period of several weeks. In India, according to Hooker, they are made into a jam called thaonti, and are also eaten while fresh. The plant does not seem to be particular regarding soil, thriving upon heavy loam or light sand. It is readily prop. by seeds, which should be sown in flats of light soil soon after they are removed from the fr., covering them to the depth of ½ in. and pricking off the young plants when 2 in. high. When set out in the open ground the plants do not grow very rapidly, but are of simple cult. In dry climates they require plenty of water.

F. W. POPENOE.

RHODORA: *Rhododendron canadense*.

RHODORHIZA (Greek, *rose root*; the root and wood furnish the fragrant powder known as *bois de rose*). *Convolvulaceae*. Rhodorhiza is a group of about 7 species, all from the Canary Is., which Benthams & Hooker and some other authors regard as a section of the genus *Convolvulus*. The Rhodorhizas differ from typical *Convolvulus* in having the caps. by abortion usually 1-seeded, and rupturing irregularly at the base instead of dehiscing by 4 valves. They are prostrate or climbing herbs or erect subshrubs, sometimes spinescent: lvs. entire, dentate, undulate or lobed: corolla broadly or narrowly bell-shaped; limb 5-angled or 5-lobed; ovary 2-loculed, 4-ovuled.

florida, Webb. (more properly *Convolvulus floridus*, Linn. f.). Erect subshrub: lvs. persistent, alternate, lanceolate, stalked, entire: fls. long-peduncled, funnel-shaped, white, sometimes pinkish white. Isl. of Terceira. R.H. 1892:156.—*R. florida* is a tender subshrub 6-9 ft. high, which bears white fls. something like morning-glory. The blossoms are about an inch across and last only a day, but a succession is maintained (i. S. France) from early June till Aug. A striking feature of the plant is its terminal, panicle infl. These panicle are often a foot high, 10 in. wide at the base and contain at one time as many as 20 full-blown fls. and 10 buds. Intro into S. Calif.

scoparia, Webb. (more properly *Convolvulus scoparius*, Linn. f.). Shrubby: sts. terete and glabrous: lvs. linear and rather pilose: fls. white, generally 3 to peduncle, hairy outside; calyx silky, the sepals ovate acute. Aug. and Sept. Isl. of Teneriffe. B.R. 27:43

—The wood of this species is hard and white, with radiating stripes. Intro. into S. Calif.

WILHELM MILLER.
F. TRACY HUBBARD.†

RHODÓSPATHA (Greek, *rose* and *spathe*, referring to the color of the spathe in some species). *Ardeez.* Climbing shrubs suitable for the warmhouse: branches often rooting: lvs. distichous, elliptic-oblong, acuminate: spathe cymbiform, beaked and deciduous; spadix shorter than the spathe, cylindrical, densely fld., the fls. all perfect or the lower pistillate; perianth none, stamens 4: berries small, oblong, truncate, 2-celled, many-seeded.—About a score species, Trop. Amer. See Engler, *Pflanzenreich*, IV. 23B.

Forgetii, N. E. Br. St. climbing: lvs. spreading; blade oblong-lanceolate, 16–20 in. long; the petiole about 12 in. long; peduncle 6 in. long; the spathe broadly elliptic, 6 in. long, a dirty pale rose-white outside and dirty rose inside. Costa Rica.

pictum, Nichols. (*Spathiphyllum pictum*, Hort. Lind.). Lvs. somewhat fleshy, broadly ovate-elliptic, 1½ ft. or more long, glossy dark green, mottled along the transverse veins with blotches of golden green. S. Amer.

RHODOSPHERA (Greek, *red* and *globe*; referring to the reddish globose fr.). *Anacardiaceae*. A tree from Austral., closely related to *Rhus* but differing chiefly in the 10 stamens and in the very short free radicle of the embryo: lvs. odd-pinnate, subcoriaceous: fls. polygamo-dioecious, in terminal and axillary panicles, red; stamens 10; styles 3, free: fr. a globose drupe. In its native country the wood is esteemed for cabinet-work and used as a yellow dye and therefore called “yellow-wood.” It is also a handsome foliage tree and is cult. in Calif. The only species is *R. rhodanthema*, Engl. (*Rhus rhodanthema*, F. Muell.). Evergreen tree to 60 or 70 ft., glabrous: lfts. 7–9, short-stalked, oblong-ovate, obtusely short-acuminate, dark green and lustrous above, lighter beneath, with tufts of hairs in the axils of the veins, 2–2½ in. long; panicles to 4 in. long; fls. small, ¼ in. across, crimson or pink: fr. globose, reddish brown, ½ in. across. Queensland and New S. Wales. Maiden, Forest Fl. New S. Wales. 1:32.

ALFRED REHDER.

RHODÓSTACHYS (Greek, *rose* and *flower-spike*, alluding to the rose-colored fls. of some species). *Bromeliaceae*. Herbs suitable for the warmhouse: lvs. rosulate, long, linear, rather stiff and spinulose-serrate: heads terminal, sessile within an involucre of numerous floral lvs.; fls. subsessile on a hemispherical or short-conical receptacle; sepals erect and strongly imbricated; petals free, imbricated; stamens free; ovary inferior. About 6 or 7 species, S. Amer. *R. andina*, Phil., is a low subcaulescent plant: lvs. linear, about 1 ft. long and 1 in. broad, aculeate-margined, glabrous: spike almost globose with scarious bracts about equaling the fls.; fls. rose; calyx-lobes lanceolate, strongly acuminate; petals nearly 1 in. long, linear-lanceolate, strongly acuminate. Chile. B.M. 7148. G.W. 3, p. 286. *R. pilcairniifolia*, Benth. & Hook. f. (*Fascicularia pilcairniifolia*, Mez). Sts. short, with some short branches at the top: lvs. many, crowded, ensiform from an ovate triangular base, about 1 ft. long and 1 in. wide, margins with short antrorse spines; the innermost lvs. bright red at their base: fls. in a dense central, sessile head, about 2 in. diam.; sepals narrowly lanceolate-acuminate; petals blue, oblong, obtuse, erect; ovary oblong, plano-convex. Chile. B.M. 8087.

F. TRACY HUBBARD.

RHODÓSTOMA (Greek, *rose* and *mouth*). *Rubiaceae*. Closely allied to *Psychotria*. *R. gardenioides*, Scheidw., a plant 2 ft. high, with opposite obovate-lanceolate dark green lvs. and white fls. in terminal cymes, from S. Amer., has previously been sparingly in cult. H.U. 6, p. 225.—A warmhouse plant. The genus *Rhodo-*

stoma is now referred to *Palicourea* and this species becomes *P. gardenioides*, Benth. & Hook.

RHODOTHÁMNUS (Greek, *rhodon*, rose, and *thamos*, shrub; alluding to the rose-colored fls.). *Ericaceae*. Dwarf evergreen shrub, with alternate small entire lvs. and rather large pink fls., usually solitary at the ends of the branchlets. Related to *Kalmia*, but anthers not in pouches: lvs. alternate: sepals 5, half as long as corolla; corolla rotate, deeply 5-lobed; stamens 10, slightly longer than corolla: fr. a 5-celled, many-seeded dehiscent caps. Charming little alpine shrub, hardy N., but somewhat difficult to cult. It thrives best in peaty porous soil of constant, moderate moisture in a partly shaded situation, and is best suited for rockeries. Prop. by seeds or layers, also by cuttings of ripened wood under glass. The only species is *R. Chamæcistus*, Reichb. (*Rhododendron Chamæcistus*, Linn. *Adodendron Chamæcistus*, Kuntze). Diffusely branched shrub, to 1 ft.: lvs. cuneate-oblong, acute, setosely ciliate, ¼–½ in. long: fls. on slender, glandular-hirsute pedicels, solitary, rarely 2 or 3 at the end of the branchlets, light purplish pink, to 1 in. across. May. Alps of E. Eu. B.M. 488. L.B.C. 15:1491. P.M. 3:169. F.S. 19:1962. F.W. 1873:321. G.C. III. 33:293. ALFRED REHDER.

RHODOTÝPOS (Greek, *rhodon*, rose, and *typos*, type; alluding to the resemblance of the flowers to those of a single rose). *Rosaceae*. Ornamental shrub, grown

chiefly for its large white flowers and for the handsome bright green foliage.

Leaves deciduous, opposite, stipulate, short-petioled, serrate: fls. solitary, short-pedicelled; sepals large, half as long as petals, outside with 4 small alternate bracts; petals 4, orbicular; stamens numerous; carpels usually 4, developing into black dry 1-seeded drupes, surrounded by the large persistent calyx.—One species in Japan. A handsome and distinct shrub, hardy as far north as Mass., with bright green foliage, conspicuous by its white fls. in spring and by its shining black fr. in autumn



3394. *Rhodotypos kerrioides*. (×¼)

and winter. It thrives well in any good soil. Prop. by seeds and by greenwood cuttings under glass early in summer; also by hardwood cuttings.

kerrioides, Sieb. & Zucc. (*R. tetrapétala*, Makino). Fig. 3394. Much-branched, spreading shrub, usually 3–6 ft. high (in Japan 15 ft.): lvs. ovate to ovate-oblong, acuminate, sharply and doubly serrate, silky-pubescent beneath when young, 1½–3 in. long; fls. pure white, 1½ in. across. May, June. S.Z. 1:99. B.M. 5805. L.I. 14. Gt. 15:505. R.H. 1866, p. 430. Gn. 6, p. 229; 34, p. 159; 43, p. 138. G. 7:18; 10:615.

ALFRED REHDER.

RHCEO (name unexplained). *Commelinaceae*. One species, from Mex. and the W. Indies, *R. discolor*, Hance, known also as *Tradescantia discolor*, L'Her.,

T. spathacea, Swartz, and *Ephemerum bicolor*, Moench B.M. 1192. G.W. 15, p. 230. From *Tradescantia* the genus is distinguished by having 1 ovule (rather than 2) in each locule of the ovary. *R. discolor* is a short-stemmed erect-growing long-lvd. plant, not unlike a broad-lvd. small pandanus in habit. Fls. white, small, and many in a boat-shaped spathe-like structure arising from the axil of the lf. and which is sessile or nearly so; sepals 3, free, more or less petal-like; petals 3, soon withering; stamens 6. Var. *vittata*, Hook. (*Tradescantia discolor* var. *vittata*, Miq. *T. discolor* var. *variegata*, Hook. *T. variegata*, Hort.), is the common form in cult. The lvs. are 8-12 in. long, dark purple beneath and longitudinally striped above with pale yellow. A striking plant for the warmhouse, or for the open in the S. B.M. 5079. F.S. 11:1169, 1170. Cult. as for warmhouse tradescantias.

L. H. B.

RHOPALA: *Roupala*.

RHOPALOBASTE (Greek, *club* or *pestle*, and *embryo*). *Palmaceæ*, tribe *Arëceæ*. A small group of Old World tropical palms of little horticultural significance: sts. simple, unarmed, crowned at the top by a large cluster of equally pinnatisect lvs.: lf.-segms. acuminate, 1-nerved; spadix appearing from among the lvs., much branched; stamens 6; fr. ellipsoid, red. Cult. as in *chrysalidocarpus*.

hexandra, Scheff. St. about 4 ft., crowned by numerous lvs. which are much divided into lanceolate lflets: spadix about 1½ ft. long, or in wild specimens longer, crowded with very small fls. Molucca and neighboring islands.—A little-known palm offered in Eu. but doubtfully cult. in Amer. outside of botanic gardens.

N. TAYLOR.

RHOPALOSTYLIS (name refers to the club-shaped spadix). *Palmaceæ*, tribe *Arëceæ*. Two species of pinnate palms, both of which are useful conservatory plants and nearly always sold as species of *Areca* or *Kentia*.

Spineless palms with medium ringed caudices: lvs. terminal, equally pinnatisect; segms. equidistant, numerous, narrowly sword-shaped, acuminate, the margins not thickened, recurved at the base, the midveins prominent, with 1-3-nerves on each side; rachis concave above, scurfy; petiole very short; sheath elongated: spadices short, spreading, with a very short thick peduncle, and fringed, rather thick, densely-fld. branches: spathes 2, symmetrical, oblong, flattened, the lower 2-winged: bracts adnate to the flower-bearing areas, subulate at the apex; bractlets scaly: fls. medium: fr. small or medium, ellipsoidal, smooth. *Rhopalostylis* belongs to the large group in which the ovule is borne on the side and is more or less pendulous, while in *Areca* and *Kentia* the ovule is at the base and erect. From the 5 cult. genera listed under *Hedyscepe* (which see) *Rhopalostylis* differs as follows: sepals of staminate fls. awl-shaped to lanceolate, not imbricated; stamens 6-12; pistillate fls. with short petals, valvate at the apex. Cult. as in *kentia*. Prop. by imported seeds under glass, over bottom heat. Hardy in S. Calif. if planted in shaded positions. Shade is necessary for thrifty growth as the fronds burn badly in the sun; and it will also furnish sufficient protection from frost.

sápida, H. Wendl. & Drude (*Arëca sápida*, Soland. *Kéntia sápida*, Mast.). **NIKAU PALM**. St. 6-30 ft. high, 6-9 in. diam., cylindrical, green or often a pale glaucous green: lvs. 4-6 ft. long, pinnate; segms. very narrow, linear; margin replicate; nerves, midrib, and petiole covered with minute scales: spadix 18-24 in. long, half inclosed in the spathe, much branched; fls. pale pinkish: fr. an ovoid drupe, brown. New Zeal. B.M. 5139.

Baüeri, H. Wendl. & Drude (*Arëca Baüeri*, Hook. *Kéntia Baüeri*, Seem. *Scaphorhiza robusta*, Hort.). Stout and taller than *R. sápida*: lvs. larger and

broader, rarely, if ever, glaucous; segms. linear-lanceolate, acuminate; nerves, midrib, and petiole sparsely scaly: spadix 1-2 ft. long scarcely inclosed by the spathe; fls. white: fr. more globose, scarlet. Norfolk Isl. and Kermadecs. I.H. 15:575. B.M. 5735.

JARED G. SMITH.
N. TAYLOR.†

RHUBARB. A garden vegetable, perennial, grown for the thick acid leaf-stalks which are used in spring for sauces and pies: *Rheum Rhaoticum*, which see, page 2927.

Rhubarb, known also as pie-plant, is a hardy plant and will withstand considerable neglect, yet, like most cultivated vegetables, it responds readily to proper care and good treatment. The large fleshy leaf-stems desired in culinary use are produced in part by the great store of plant-food held in reserve by the many big roots. Everything should be done to increase this supply of reserve food. Tillage and fertilizing, therefore, are fundamentals. In the choosing of a site a southern exposure is preferred, with sufficient slope to give good drainage. Plow the ground 6 to 8 inches deep, draw furrows 5 feet apart, set the plants 3 feet apart, with the buds 1 inch below the level of the ground. In home grounds, spade or trench the land deep, and set about 4 feet apart each way; or if in only one row or line with plenty of room on either side, the plants may go 3 feet or even as close as 2½ feet if they are well manured and often renewed. If the soil lacks in fertility, mix compost with the earth that is placed about the roots; never put fresh manure next to the roots. As soon after planting as possible, start the cultivator, and give a thorough stirring at intervals of six to eight days up to the middle or last of August. After the ground is frozen, cover the rows 3 to 4 inches deep with manure that is as free as possible from weed and grass seed. As early in the spring as the ground can be worked to advantage, start the cultivator and work the manure into the soil. Each alternate season the surface of the soil should have a good dressing of manure. For garden culture, a similar practice should be undertaken with the hoe or other hand tools.

In field culture, the third or fourth year after planting the hills should be divided. Remove the earth from one side of the hill and with a sharp spade cut through



3395. Stalks of forced rhubarb. The leaf-blades do not develop.

the crown, leaving three or four buds in the hill undisturbed. This work should be done in the fall or early in the spring. In garden culture, the beds should be similarly renewed, at least as often as every four or five years, but more pains may be taken in dividing the plants. The clumps of roots grow so large, and have so many eyes, that the stalks soon become more numerous than desirable, and run down in size. Take up the entire roots and cut them in pieces, leaving only one strong eye to the piece, and plant the pieces in a newly prepared bed (or even in the old one if properly enriched and prepared) 4 feet apart each way as before.

Seed-stems are produced freely the entire season. These should be promptly pulled up, unless seed is wanted. The growth of these stems and the production of seed tend to lessen the vitality of the plant and to reduce the yield.

Propagation of rhubarb is commonly by division c

the roots, and this is the only method by which a particular type can be increased. Propagation from seed, however, sometimes proves satisfactory, and always interesting as the seedlings vary greatly. The seed germinates easily, and if started early the plants become fairly large and strong the same season. The seedlings may be started in any good clean garden soil. Sow seed in early spring, in rows a foot apart and not over an inch deep. Thin the plants promptly to stand a few inches apart in the rows, and give the same thorough tillage allowed to other garden crops. In the following fall or spring take the seedlings up, and set them in the well-prepared permanent patch, not less than 4 feet apart each way, and till frequently the entire season. In spring of the next year the stalks may be pulled freely.

From ten to twenty good plants should supply the needs of the usual family, and probably with something to spare for the neighbors. Sometimes an early supply is secured by placing a bottomless barrel or box over the plant and piling warm horse-manure about it. If the barrel, keg, or box is not too broad, the petioles will make a straight upright growth and will be partially blanched and very tender. Victoria and Linnæus are the leading varieties.

L. H. B.†

Forcing of rhubarb.

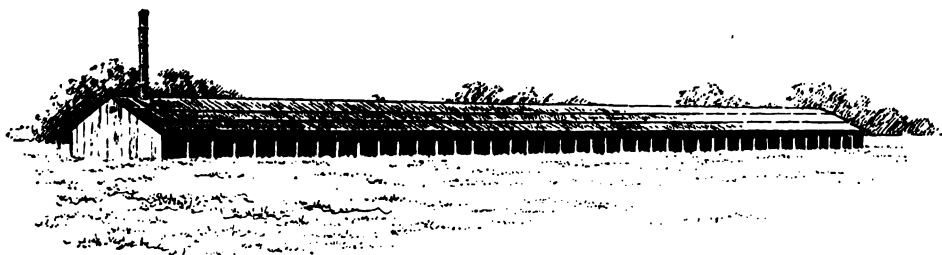
In the winter and early spring months, the forcing of rhubarb in the vicinity of many city markets is a profitable industry. The plant may be forced either in the field where the roots were grown or lifted and placed in hotbeds, under greenhouse benches or in cellars. The bulk of the rhubarb forced for market and sold during the winter months is grown in cheap structures placed over the plants in the field. These houses may be of the lean-to type, although they are more commonly even-span post and rafter construction, the roof being covered with hotbed sash which is not needed for other purposes at the time. The side walls are 4 to 5 feet high, made of rough boards and covered with cheap building-paper. The even-span houses are mostly 24 to 36 feet wide and the lean-to house half that width. Heat is usually applied in an overhead system, steam being the most popular, although late in the season the sun is depended upon to supply the required amount of heat. When forced in the field in limited quantities, coldframes are often used, the outside walls being well banked with hot manure and the surface of the ground within the frames covered with 3 to 6 inches of the same material.

Beds intended for early spring forcing should be thoroughly cultivated in the fall and an application made of high-grade commercial fertilizer of 800 to 1,000 pounds to the acre. When growth starts, a dressing of nitrate of soda at the rate of one-half pound to a crown should be given. In field forcing, the moisture of the soil is usually sufficient so that no water is applied. When it is the intention to use a field for forcing for several years, the plants are usually set 2 by 3 feet and the land fertilized heavily each spring with a compost, one made from cow- and hog-manure being preferred. The sash are placed upon the first houses as soon as the roots have been frozen, five to seven weeks being necessary to bring the plants to maturity.

In field forcing, the cost of production is often greatly reduced by growing spinach or dandelion between the

rows, the price obtained for these fillers usually being sufficient to pay labor and maintenance costs. The stalks are usually pulled twice, returning to the grower from \$1 to \$2 a sash, depending upon the season when placed upon the market.

Roots for forcing in the dark should be healthy and vigorous; the larger the roots the more satisfactory the results as a general rule. Crowns three to five years of age are mostly used, although satisfactory results are often obtained from one-year-old plants which have been



3396. House for the forcing of rhubarb, covered with movable sash.

grown on very rich land and have made an unchecked growth during the season. The roots should be dug early in the fall before the ground freezes and allowed to remain exposed to the weather until they are frozen solid when they should either be removed to a shed or covered with litter in the field to prevent alternate freezing and thawing. Thorough freezing is necessary, whatever the method of forcing, if the best results are to be obtained. With one-year roots very satisfactory results are sometimes secured if the roots are thoroughly dried before forcing. Anesthetics have been tried as a substitute for freezing but with unsatisfactory results. When used upon frozen roots they stimulate growth, resulting in the production of earlier and larger stalks with greater total weight of product. If the greatest benefit is to be derived from the anesthetic, it must be used in the early part of the resting-period. The most satisfactory results have been obtained by the use of 10 cubic centimeters of sulfuric ether to a cubic foot of space, exposing the roots to the fumes for forty-eight hours. Well-grown two-year-old roots seem to respond to this treatment in the most satisfactory way.

As soon as the roots are placed in position, whether it be under the greenhouse benches or in the cellar, all spaces should be filled with soil or ashes to prevent evaporation. If placed on a concrete floor, 2 or 3 inches of soil should be placed under the roots and sufficient material should be added completely to cover the roots. The bed as soon as completed should be thoroughly watered, the plants kept supplied with an abundance of moisture, which will necessitate water being applied about once a week. Care should be taken to guard against over-watering as this will result in the production of light-colored stalks, lacking in flavor and texture. In order to obtain the most attractive product, rhubarb should not be forced in full light or total darkness. If grown in diffused light, the development of the leaf-blade is very slight and the color of the stalk, instead of being green, is a beautiful dark cherry-red, giving to the product a very attractive appearance. In quality the product is superior to that forced in light, being more tender, less acid, with a skin so thin and tender as to make it unnecessary to peel the stalks. The temperature may range from 45° to 75°, the lower the temperature the greater the yield and higher the quality of the product. The time required for bringing a crop to maturity in darkness is practically the same as that required for forcing in the field.

Local market demands to a certain extent govern the method which is used in growing this crop for the winter market. When grown by any method which

requires the lifting of the roots, it must be remembered that they are worthless after having produced a crop. Therefore, this method cannot be practised with as great profit upon expensive land as can the method of field forcing or when roots were used for forcing which otherwise would be destroyed. Rhubarb-forcing in house cellars should receive more attention, as it adds at slight expense a pleasing vegetable to the winter dietary.

Whatever the method practised, success will be attained only when healthy well-developed roots, which have been allowed to freeze, are used. G. E. ADAMS.

RHŪS (ancient Greek name). *Anacardiaceae*. **SUMAC**. Ornamental woody plants, grown chiefly for their handsome foliage, often assuming brilliant autumnal colors, and some species also for their showy fruiting panicles. See also *Cotinus*.

Deciduous or evergreen shrubs, sometimes climbing by aerial rootlets, or trees, with milky or resinous juice: lvs. alternate, without stipules, simple, 3-foliate or odd-pinnate: fls. dioecious or polygamous, small, in axillary or terminal panicles; calyx 5-parted; petals 5, imbricate; stamens 5, inserted below a broad disk; ovary superior, with 3 styles: fr. a small 1-seeded dry drupe, smooth or hairy.—About 150 species in the temperate and subtropical regions of both hemispheres. Foliage and bark of most species are rich in tannin and are used for tanning leather, particularly the lvs. of *R. coriaria* in S. Eu. From *R. verniciflua* lacquer is obtained in China and Japan, used in the manufacture of lacquer-ware; *R. succedanea* yields a vegetable wax, used for candles in Japan, and also exported for various purposes. *R. laevigata* and some other S. African species are valued for their timber.

The sumacs are shrubs or trees with handsome simple or usually compound foliage assuming in most deciduous species brilliant autumnal colors, and with small comparatively inconspicuous flowers in usually large panicles, followed by small fruits which are deep red and showy in many species. The only species with rather showy flowers of creamy white color appearing in late summer is *R. javanica*, while *R. typhina*, *R. glabra*, and *R. copallina* are chiefly valued for their large pinnate leaves coloring scarlet in autumn and also for the conspicuous panicles of deep red fruits remaining almost unchanged on the plants during the winter; they are well adapted for mass-planting on barren ground and dry hillsides. Also *R. verniciflua*, *R. succedanea*, and *R. vernix* have handsome large foliage, but are poisonous like *R. Toxicodendron*, and for this reason are not recommended for extensive planting. The deciduous native species are hardy North, and *R. verniciflua*, *R. Potaninii*, *R. punjabensis* var. *sinica*, *R. javanica*, *R. trichocarpa*, and *R. sylvestris* are hardy as far north as Massachusetts, while *R. coriaria* is tender, and the evergreen species can be grown only in warmer temperate regions. Most species grow well in dry and barren soil, only *R. vernix* is a swamp-loving plant. Many species, particularly *R. Toxicodendron*, *R. glabra*, *R. typhina*, and *R. copallina*, spread by suckers and may become a nuisance in lawns and mixed plantations. Propagation is by seeds sown in autumn or stratified; all species grow readily from root-cuttings; some species, as *R. canadensis*, may be increased by layers or cuttings of mature wood.

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KEY TO THE SPECIES.

- A. *Foliage simple, evergreen.*
 - B. *Lvs. glabrous.*
 - C. *Fr. pubescent, red.*
 - D. *Length of lvs. 1-2 in., apex usually obtuse.* 1. *integrifolia*
 - DD. *Length of lvs. 2-3 in., apex acute* 2. *ovata*
 - CC. *Fr. glabrous, whitish* 3. *laurina*
 - BB. *Lvs. pubescent* 4. *mollis*
- AA. *Foliage compound.*
 - B. *Lfts. 5.*
 - C. *Plant evergreen.*
 - D. *Petiole slender, terete* 5. *laevigata*
 - DD. *Petiole short, winged* 6. *lucida*
 - CC. *Plant deciduous.*
 - D. *Fls. in dense catkin-like racemes: fr. hairy, red.*
 - M. *Lfts. glabrate, 1/2-1 in. long, with few rounded teeth* 7. *trilobata*
 - EE. *Lfts. pubescent, 1-3 in. long, crenate-serrate* 8. *canadensis* ✓
 - DD. *Fls. in loose panicles: fr. glabrous, whitish.*
 - E. *Apex of lfts. obtuse, margin crenate* 9. *diversiloba*
 - EE. *Apex of lfts. acute, margin entire or serrate* 10. *Toxicodendron* ✓ [dron]
 - BB. *Lfts. 6 or more.*
 - C. *Inf. axillary: fr. glabrous, whitish: lfts. entire; lvs. crowded at the end of the branches.*
 - D. *Under side of lfts. more or less pubescent, at least while young, pale green; texture thin; pairs of veins usually 10-12.*
 - E. *Length of lfts. usually 2-4 in., base cuneate* 11. *vernix*
 - EE. *Length of lfts. usually 4-6 in., base usually rounded* 12. *verniciiflua*
 - DD. *Under side of lfts. glabrous, grayish green, rarely green; texture firm; with usually 15-30 pairs of veins* 13. *succedanea*
 - CC. *Inf. terminal: fr. hairy, red.*
 - D. *Fruiting panicles pendulous: lfts. entire, or sometimes serrate in young plants; rachis not or slightly winged.*
 - E. *Number of lfts. 5-7, rarely to 9; rachis terete* 14. *Potaninii*
 - EE. *Number of lfts. 7-13; rachis narrowly winged in the upper part* 15. *punjabensis*
 - DD. *Fruiting panicle upright: lfts. serrate except in No. 18.*
 - E. *Rachis winged.*
 - F. *Lfts. obtusish, rarely over 2 in. long* 16. *coriaria*
 - FF. *Lfts. acute, over 2 in. long.*
 - G. *Margin of lfts. coarsely serrate, base usually rounded* 17. *javanica*
 - GG. *Margin of lfts. entire or remotely serrate, base cuneate* 18. *copallina* ✓
 - EE. *Rachis terete, or in No. 19 often winged below the terminal lfts. only.*
 - F. *Lvs. densely brownish pubescent beneath: low shrub to 3 ft.* 19. *Michauxii*
 - FF. *Lvs. glabrous beneath or pubescent on the veins, glaucous.*
 - G. *Branchlets and infl. densely hairy* 20. *typhina* ✓
 - GG. *Branchlets glabrous, glaucous: infl. finely pubescent* 21. *glabra*

1. *integrifolia*, Brew. & Wats. Shrub or small tree, occasionally to 30 ft.: lvs. short-stalked, oval, obtuse or sometimes acute, entire or spinosely toothed, glabrous, 1-2 in. long, very rarely 3-foliate: panicles hoary-pubescent, 1-3 in. long; fls. white or pinkish: fr. ovate,

flattened, $\frac{1}{2}$ in. long, dark red. Spring. Calif. S.S. 3:109.

2. *ovata*, Wats. Shrub, to 10 ft.: lvs. short-stalked, ovate, acute or acuminate, entire or rarely spinosely toothed, 2-3 in. long: fls. in dense spikes $\frac{1}{2}$ in. long, sometimes crowded into terminal panicles, light yellow: fr. ovate, flattened, dark red, $\frac{1}{4}$ in. long. Spring. S. Calif., Ariz.

3. *laurina*, Nutt. (*Lithræa laurina*, Walp.). Aromatic, glabrous shrub: branchlets purplish: lvs. oblong-ovate to lanceolate, acute and mucronate, rounded at the base, entire, 2-3 in. long; petioles $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long: fls. in dense panicles, to 4 in. long, greenish white: fr. ovoid, beaked, $\frac{1}{6}$ in. long, whitish, with a waxy covering. Summer. S. and Low. Calif.—Will thrive in the hottest and driest places; very handsome with its dark green glossy foliage.

4. *mollis*, HBK. Tall shrub: branchlets tomentose: lvs. oval or ovate, rounded and mucronate at the apex, rounded or subcordate at the base, pubescent above, more densely so beneath, 1 $\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; petiole very short: fls. in dense pubescent panicles, about 1 in. long: fr. subglobose, pilose. Mex.

5. *lævigata*, Linn. Glabrous shrub or tree: petiole 2-3 in. long; lfts. sessile or short-stalked, ovate, acuminate, cuneate at the base, entire or sometimes with 2-6 teeth, lustrous above, 2-3 in. long: panicles loose, axillary and terminal; fls. minute, whitish, slender-pedicelled: fr. globose, glabrous, lustrous, about $\frac{1}{4}$ in. across. S. Afr. Sim, For. Fl. Cape Colony 45.

6. *lucida*, Linn. Glabrous shrub, to 6 ft.: branchlets sometimes puberulous: petiole $\frac{1}{4}$ - $\frac{1}{2}$ in. long, narrowly winged; lfts. sessile, obovate, obtuse or emarginate, entire, rarely slightly toothed, lustrous, distinctly veined, 1-2 $\frac{1}{2}$ in. long: panicles terminal and axillary, about as long as lvs.: fr. globose, glabrous, about $\frac{1}{4}$ in. across. S. Afr.

7. *trilobata*, Nutt. (*Schmaltzia trilobata*, Small). SKUNK-BUSH. ILL-SCENTED SUMAC. Offensive-scented shrub, to 3, rarely to 6 ft. high: lvs. petioled, 1-2 in. long; lfts. sessile or nearly so, oval or obovate, obtuse, crenately toothed, puberulous while young, soon glabrous, the terminal one usually 3-lobed: fls. greenish, in clustered spikes before the lvs.: fr. subglobose, red, hairy, $\frac{1}{4}$ in. across. Mo. to Wash., Calif., and Texas. B.B. (ed. 2) 2:483.

8. *canadensis*, Marsh. (*Schmaltzia aromatica*, Desv. *R. aromatica*, Ait. *Schmaltzia crenata*, Greene). Aromatic shrub, to 3 ft., with ascending or diffuse branches: lvs. petioled, 2-4 in. long; lfts. pubescent, the terminal one ovate or obovate, acute or acuminate, cuneate at the base; the lateral lfts. ovate, unequal at the base: fls. and frs. like those of the preceding species, but fls. yellow and frs. slightly larger. Ont. and Vt. to Minn. and south to Fla. and La.—A good cover plant for dry rocky banks; conspicuous in early spring by its yellow fls. B.B. (ed. 2) 2:482.

9. *diversiloba*, Torr. & Gray. POISON OAK. Upright shrub or sometimes climbing by rootlets: branchlets pubescent: lfts. ovate, elliptic or obovate, usually obtuse, coarsely crenate-serrate or 3-lobed, sparingly

pubescent while young, 1-3 in. long: fls. yellowish green, in peduncled panicles: fr. white, $\frac{1}{2}$ - $\frac{1}{4}$ in. across, falling soon after maturity. Brit. Col. to Calif.—Poisonous like the following and not to be recommended for planting.

10. *Toxicodendron*, Linn. (*Toxicodendron vulgare*, Mill. *R. radicans*, Linn. *R. Toxicodendron* var. *radicans*, Torr.). POISON IVY. POISON OAK. Fig. 3018, p. 2678. Suberect and scrambling over walls and fences or high-climbing by aerial rootlets: lfts. ovate or rhombic, acute or short-acuminate, entire or sparingly dentate or sinuate, more or less pubescent beneath, 1-6 in. long: fls. greenish, in loose axillary panicles 1-3 in. long: fr. whitish, subglobose, $\frac{1}{6}$ in. across, remaining on the plant during the winter. Spring. Nova Scotia to Fla. west to Minn., Neb., and Ark. Em. 577.—It colors beautifully scarlet and orange in autumn, but is very poisonous to many and therefore should not be planted

near places where persons are likely to come in contact with it; in such places it should rather be extirpated. It is, however, very difficult to eradicate, for it spreads by suckers and each piece of root left in the ground sprouts again.—The plant described above is

by some called *R. radicans*, Linn., and the name *R. Toxicodendron* is restricted to an upright shrubby form with pubescent crenate or crenately lobed lvs., native to the S. Atlantic states, also called *R. quercifolia*, Steud.; also several

other closely related species have been distinguished.

11. *vernix*, Linn. (*R. venenata*, DC.). POISON SUMAC. POISON ELDER. Fig. 3019, p. 2678. Shrub or tree, to 20 ft.: lfts. 7-13, oval to oblong, acuminate, cuneate at base, undulate, glabrous or slightly pubescent beneath usually 2-4 in. long: fls. greenish, in loose axillary panicles 3-8 in. long: fr. subglobose, gray, flattened, $\frac{1}{2}$ in. across. Swamps, R. I., Ont., and Minn., south to Fla. and La. S.S. 3:107, 108. Em. 575.—Very poisonous: foliage turns to a brilliant scarlet in autumn.

12. *verniciflua*, Stokes (*R. verniciifera*, DC. *R. vernix*, Thunb.). VARNISH-TREE. LACQUER TREE. Tree, to 60 ft.: lfts. usually 11-15, short-stalked, ovate-oblong to oblong-lanceolate, acuminate, rounded or broadly cuneate at the base, entire, more or less pubescent beneath while young, 3-6 in. long: fls. whitish, in slender axillary panicles about half as long as the lvs.: fr. broader than long, compressed, straw-yellow, smooth, $\frac{1}{4}$ in. broad. May. Japan, China, Himalayas. S.I.F. 1:57. I.T. 6:201. Gn. 34, p. 158.—From this tree the lacquer used for the highly polished woodenware is obtained in Japan and China; the fr. yields a fatty oil. The tree is poisonous like the preceding species.

13. *succedanea*, Linn. WAX-TREE. Shrub or small tree, to 30 ft.: lfts. 9-15, short-stalked, elliptic-oblong to oblong-lanceolate, long-acuminate, broadly cuneate at the base, entire, lustrous above, usually grayish green or glaucescent beneath, quite glabrous, usually with 15-20 pairs of veins prominent beneath, 2-4 in. long: fls. yellow-green, in axillary slender panicles: fr. broader than high, compressed, whitish, $\frac{1}{3}$ - $\frac{1}{4}$ in. broad. May.



Japan, China, Himalayas. S.I.F. 1:57. R.H. 1863, p. 130.—From the fr. of this tree a wax-like substance chiefly used for making candles is expressed in Japan. The tree is poisonous.

14. *Potaninii*, Maxim. (*R. sinica*, Koehne, not Diels). Shrub or tree, to 25 ft.: branchlets minutely puberulous: rachis terete or sometimes slightly winged between the



3398. *Rhus typhina*.—Staghorn sumac.

upper lfts.; lfts. 5-7, short-stalked, ovate or elliptic-ovate, acuminate, rounded or broadly cuneate at the base, entire, on young plants usually coarsely toothed, pubescent beneath on the veins, 2-4 in. long: fls. whitish, in terminal panicles: fr. dark red, densely hairy, in pendulous panicles to 5 in. long. May, June. Cent. and W. China. M.D. 1910, p. 103, and G.M. 51:419; 52:721 (as *R. sinica*).

15. *punjabensis*, Stew. Tree, to 40 ft.: branchlets short-pubescent: lfts. short-stalked, oblong or ovate-oblong, acuminate, rounded or subcordate at the base, slightly pubescent beneath, at least on the veins, entire, 3-5 in. long: fls. whitish, in broadly pyramidal panicle with spreading branches: fr. suborbicular, red, tomentose, $\frac{1}{4}$ - $\frac{1}{2}$ in. broad. Himalayas. Var. *sinica*, Rehd. & Wilson (*R. sinica*, Diels). Upper part of the rachis narrowly winged; lfts. 7-11, on young plants sometimes 17 and wings more pronounced and often continuing down the whole length of the rachis: fruiting panicle 5-8 in. long and 4-6 in. broad. June, July; fr. in Sept. Cent. and W. China.—This and the preceding species are strong-growing plants with handsome foliage; very attractive in autumn with their large pendulous panicles of dark red fr.

16. *coriaria*, Linn. Shrub, to 20 ft.: petiole short; rachis winged, at least in the upper part, villous; lfts. 9-15, oval to oblong, obtuse or acutish, coarsely toothed, pubescent beneath, $1\frac{1}{2}$ -2 in. long: fls. greenish, in a rather loose terminal panicle: fr. crimson, densely pubescent. July. Medit. region, W. Asia. H.W. 3, p. 33.—The lvs. are used for tanning leather.

17. *javanica*, Linn. (*R. semialata*, Murr. *R. Osbeckii*, Decne. *R. semialata* var. *Osbeckii*, DC.). Fig. 3397. Shrub or flat-headed tree, to 25 ft.: rachis and often the petiole winged, pubescent; lfts. 7-13, short-stalked or nearly sessile, ovate to ovate-oblong, acute or short-acuminate, rounded or broadly cuneate at the base, coarsely crenate-serrate, brownish pubescent beneath, 2-6 in. long: fls. creamy white, in large and broad panicles, to 12 in. long: fr. subglobose, compressed, red, densely pubescent. Aug., Sept.; fr. in Oct. Japan, China, S. Asia. S.I.F. 1:58. G.W. 1:99. M.D.G. 1899:166.—Valuable for its late blooming season and the most showy of the sumacs in bloom. Var. *Roxburghii*, Rehd. & Wilson (*R. semialata* var. *Roxburghii*, DC.). Rachis not or very slightly winged. Himalayas.—Tender, rarely cult.

18. *copallina*, Linn. (*Schmaltzia copallina*, Small). BLACK SUMAC. MOUNTAIN OR SHINING SUMAC. Shrub

or tree, occasionally to 30 ft.: rachis winged, pubescent; lfts. 9-21, oblong-ovate to oblong-lanceolate, entire or few-toothed toward the apex, glabrous and lustrous above, usually pubescent beneath, $1\frac{1}{4}$ -4 in. long: fls. greenish, in dense terminal panicles: fr. compressed, hairy, crimson. July, Aug.; fr. Sept., Oct. Maine and Ont. to Minn., south to Fla and Texas. S.S. 3:104, 105. Var. *lanceolata*, Gray. Lvs. narrowly lanceolate, often falcate. Texas. S.S. 3:106.—Succeeds well in dry soil; handsome with its dark green glossy foliage.

19. *Michauxii*, Sarg. (*R. pumila*, Michx. *Schmaltzia Michauxii*, Small). Low shrub with decumbent sts. about 1 ft. high, densely pubescent: lfts. 9-15, oval to oblong-ovate, acuminate, coarsely serrate, 2-4 in. long: fls. greenish, in panicles 4-8 in. long: fr. compressed, deep red, pubescent. Spring. N. C. to Ga. G.F. 8:405.—Poisonous.

20. *typhina*, Linn. (*R. hirta*, Sudw. *Schmaltzia hirta*, Small). STAGHORN SUMAC. Fig. 3398. Shrub or tree, to 30 ft.: branchlets densely velvety-hairy: lfts. 11-31, oblong-lanceolate, pointed, serrate, glaucescent beneath, 2-5 in. long: fls. greenish, in dense terminal panicles: fr. crimson, hairy. June, July; fr. Aug., Sept. Em. 571. S.S. 3:102, 103. Gn. 54, p. 505. G.F. 2:343 (adapted in Fig. 3398). Que. to Ont., south to Ga., Ind., and Iowa. Var. *laciniata*, Wood. Lfts. and bracts deeply and laciniately toothed and the infl. sometimes partly transformed into contorted bracts. Var. *dissecta*, Rehd. (var. *laciniata*, Hort.). Fig. 3399. Lfts. pinnately dissected. M.D.G. 1900:211. G.M. 53:827. R.H. 1907, pp. 10, 11. A very handsome form with finely cut foliage. *R. typhina filicina*, Sprenger, is probably not different.—The staghorn sumac grows in the driest soils and is a very desirable plant on account of its brilliant fall coloring, which in dry localities begins to show in Aug., and with its crimson fr.-clusters persisting through the winter. Trained in tree form it is very picturesque, but is short-lived.

21. *glabra*, Linn. (*Schmaltzia glabra*, Small). SMOOTH SUMAC. Fig. 3400. Shrub, to 15 ft. with glabrous and glaucous branches: lfts. 11-31, lanceolate-oblong, pointed, serrate, glaucous beneath, 2-5 in. long: fls. green, in dense panicles, to 10 in. long: fr. scarlet, viscid-pubescent. July; fr. in Aug., Sept. Em. 572. G.W. 3, p. 145. F.E. 30:681. Var. *laciniata*, Carr. Lfts. pinnately dissected. F.E. 31:875. G. 1:533. R.H. 1863, p. 7. V. 10:101. This variety with its deeply and finely cut lvs. is very handsome; it is tenderer than the cut-lvd. form of the preceding species and does not grow so high.

R. cotinoides, Nutt.—*Cotinus americana*.—*R. Côtinus*, Linn.—*Cotinus Coggygia*.—*R. Delavayi*, Franch. Allied to *R. succedanea*. Glabrous shrub: lfts. 5-7, elliptic, 1-2 in. long, light green beneath:



3399. Young plants of *Rhus typhina* var. *dissecta*.

infl. 2-3 1/4 in. long. W. China. Var. *quinquejuga*, Rehd. & Wilson. Lfts. 5-11, slightly pubescent while young. W. China.—*R. hybrida*, Rehd. Hybrid between *R. glabra* and *R. typhina*, found occasionally among the parents: young branchlets sparingly or densely pubescent: lfts. on the veins beneath slightly pubescent: hairs of the fr. exactly intermediate in length between those of the parents.—*R. orientalis*, Schneid. (*R. Toxicodendron* var. *hispida*, Engl.). Allied to *R. Toxicodendron*. Climbing: young branchlets hairy: lfts. dull green above, entire: fr. pilose. Japan, China.—*R. rhodanthema*, F. Muell.—*Rhodospheera rhodanthema*.—*R. sylvestris*, Sieb. & Zucc. Allied to *R. succedanea*. Shrub or tree, to 30 ft.: young branchlets, rachis, and lfts. beneath pubescent. Japan, China. S.I.F. 1:58.—*R. tomentosa*, Linn. Allied to *R. laevigata*. Shrub or small tree: lfts. 3, oblong, entire or crenate-dentate,



3400. *Rhus glabra*. (X 1/2)

tomentose beneath, 1 1/4-3 in. long. S. Afr. I.T. 3:111.—*R. trichocarpa*, Miq. Allied to *R. verniciflua*. Shrub or small tree: petiole and lfts. beneath pubescent; lfts. usually smaller: panicle shorter and denser: fr. pilose. Japan, China.

ALFRED REHDER.

RHYNCHÁNTHUS (Greek, *beak* and *flower*, referring to the peculiar shape of the fls.). *Zingiberaceae*. Slender glabrous perennial herbs with tuberous roots, suitable for the warmhouse: sts. erect, leafy, the lvs. sessile: fls. sessile, borne in a terminal, few-fl. spike; bracts solitary, elongate, and colored; calyx tubular, cylindrical; corolla funnel-shaped, the lobes ovate-lanceolate, acuminate, and erect; ovary 3-celled.—About 3 or 4 species, Burma. *R. Bluthianus*, Wittm. Sts. up to 1 ft. high, not thickened at the roots: lvs. 4, oblong-lanceolate, sessile, acuminate, not marginate: fls. 2, up to 2 in. long; calyx beautiful red, truncate, 3-toothed; corolla red; ovary smooth. Burma. Gt. 48:1464. *R. Johnianus*, Schlecht. Tuberous: up to 4 1/2 ft. high: lvs. distichous, lanceolate, acuminate, both sides glabrous: infl. many-fl., oblong, with bright red, lanceolate, acuminate bracts; fls. sulfur-yellow; calyx cylindrical, split, the apex 2-cleft; corolla 3-cleft to below the middle, the segms. lanceolate, acuminate; ovary cylindrical. Burma. Gt. 56:1560. *R. longifolius*, Hook. f. Sts. 1 1/2 ft. high, thickened at the roots: lvs. 8-12, regularly distichous, 5-7 in. long, oblong-lanceolate, acuminate, red-margined: fls. 4-5, up to 3 1/2 in. long; calyx slightly shorter than the bracts; corolla-tube pale yellow-green, lobes green; ovary puberulous. Burma. B.M. 6861.

F. TRACY HUBBARD.

RHYNCHÔSIA (Greek, *beak*, alluding to the shape of the keel). *Leguminosae*. Twining, prostrate, or rarely erect herbs, shrubs, or subshrubs, suitable for the warmhouse or outdoors in the southernmost parts of the United States.

Plants often glanduliferous, with minute yellow glands: lvs. pinnately, or rarely subdigitately, 3-divided: fls. yellow, mostly in axillary racemes; calyx unequally 3-cleft or 4-5-parted; standard rounded, often darkly lined, rarely purple: legume compressed continuous.—About 100 species in the warmer regions of both hemispheres. The name *Dolicholus* is sometimes used for this genus, but *Rhynchosis* is one of the names maintained by the "nomina conservanda" accepted by the Vienna Congress.

mnima, DC. Tomentose or glabrescent herb: st. about 1 ft. high, low, twining, obtuse-angled: lfts. ovate-rhomboid, rather acute: fls. racemose, distant; calyx-lobes lanceolate-linear, the inferior about half as long as corolla: legume not constricted, oblong, tapering at the base, pubescent; seeds black. Texas, Mex. to Brazil, W. Indies, Trop. Afr., and Asia.

phaseoloides, DC. Tomentose or glabrate, a high climber, subshrubby: st. twining and subcylindrical: lfts. ovate or ovate-rhomboid, pointed: racemes many-fl.; calyx-lobes ovate-lanceolate or ovate, pointed, the inferior half as long as the standard: legume constricted between both seeds, tomentose or glabrescent; seeds black, with a scarlet-yellow ring around the hilum. Panama to Brazil, W. Indies and Galapagos Isls.

F. TRACY HUBBARD.

RHYNCHOSPÉRMUM (Greek, *beak* and *seed*, referring to the form of the seed). *Apocynaceae*. Now referred to *Trachelospermum*. *R. jasminoides*, Lindl. = *Trachelospermum jasminoides*, Lem., which see. There is, however, a good botanical genus named *Rhynchosperrum*, but it belongs to the composite family. It has only one species, *R. verticillatum*, a plant not in cultivation.

RHYNCHÓSPORA: *Rhynchospora*.

RHYNCHÓSTYLIS (Greek, *beaked column* or *style*). *Orchidaceae*. Epiphytic herbs closely related to *Saccolabium* and usually sold under that name.

Stems monopodial and 2-ranked: lvs. crowded, leathery or fleshy: fls. in dense racemes from the axils of the lvs., medium-sized; dorsal sepal and petals sub-similar, lateral sepals broader, decurrent on the foot of the column; labellum firmly joined to the base of the column, obovate, inflexed at the apex, not 3-lobed, spurred, the spur straight or curved backward. For cult., see *Saccolabium*.

retusa, Blume (*Saccolabium guttatum*, Lindl. *S. præmorsum*, Lindl. *S. Rheedii*, Wight. *S. retusum*, Voigt. *S. Blumei*, Lindl.). St. stout, with channeled lvs. 6-20 in. long: fls. in dense, cylindrical racemes about as long as the lvs., 1/4 in. across, white, blotched with pink or violet. June, July. Trop. India and Malay Isls. B.M. 4108. F.S. 7, p. 92; 14:1463, 1464. B.R. 1443 (as *Sarcanthus guttatus*). G.C. 1845:364; II. 1:219; 23:573; III. 15:812. Gn. 31, p. 537. A.G. 20:317. S.H. 2, p. 375.—Several varieties are in the trade. Var. *majus*, Hort. Larger in all its parts. I.H. 15:545. Gn. 31, p. 69; 36, p. 230 (all as *Saccolabium Blumei* var. *majus*). Var. *Holdfordiana*, Hort., an old form with large racemes of waxy white fls., spotted with crimson, the lip being also crimson. Var. *gigantæa*, Hort., very much like the type. Var. *alba*, Hort. Fls. entirely white. Var. *Dayi* and var. *superba* are offered.

violacea, Reichb. f. (*Saccolabium violaceum*, Reichb. f.). Lvs. 10-12 in. long: racemes 1 ft. or more long; fls. 1 in. across, white, spotted with pale mauve; labellum dark violet. Jan. Philippines. B.R. 33:30 (as *Vanda*).—The blossoms are said to have a disagreeable odor. Var.

Harrisonianum, Hort. (*Saccolabium Harrisonianum*, Hook.). Lvs. distichous, oblong, obliquely bifid at the apex; raceme dense, cylindrical, pendulous; fls. white, fragrant; sepals ovate-oblong, somewhat incurved; petals narrower, oblong-spatulate; labellum oblong-obovate, with a thick blunt apiculus, saccate toward the apex; spur blunt; disk with a single thickened line. Malay Isls. B.M. 5433. F.S. 23:2412.—The racemes grow to a length of 2 ft.

celéstis, Reichb. f. (*Saccolabium celéstis*, Reichb. f.). St. rather stout: lvs. 4-6 in. long, fleshy; peduncles erect, bearing a dense raceme: fls. crowded, $\frac{3}{4}$ in. across; sepals and petals similar, oval-oblong, obtuse, white with a blotch of indigo at apex; lip obovate-oblong, white at base, bright indigo at apex. Siam.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

RHYTIGLOSSA (Greek, *wrinkle* and *tongue*, the palate of the lower lip is wrinkled). *Acanthaceae*. A genus in which about 75 species have been described, now referred to *Dianthera*, which see.

RIBES (probably derived from *ribas*, the Arabic name for *Rheum Ribes*, or by some supposed to be the Latinized form of *riebs*, an old German word for currant). *Saxifragaceae*. CURRANT. GOOSEBERRY. Woody plants partly grown for their edible fruits and partly for their handsome flowers, fruits, or foliage.

Unarmed or prickly shrubs with deciduous or rarely evergreen foliage: lvs. alternate, often fascicled, simple, usually palmately lobed and mostly plaited in the bud: fls. perfect or in some species dioecious, 5-merous, rarely 4-merous, in many-fld. to few-fld. racemes, or solitary; calyx-tube cylindric to rotate, like the sepals usually colored; petals usually smaller than the sepals, often minute, rarely entirely wanting; stamens alternating with the petals, shorter or longer than the sepals; ovary inferior, 1-celled; styles 1 or 2 (Fig. 3401): fr. a many-seeded pulpy berry, crowned by the remains of the calyx.

—About 150 species in the colder and temperate regions of N. and S. Amer., N. and Cent. Asia, Eu., and N. Afr. The genus is sometimes divided into two: the true Ribes with usually unarmed sts., racemose fls., and jointed pedicels, and Grossularia (p. 1414) with prickly sts.; fls. solitary or in short 2-4-fld. racemes and with the pedicels not jointed. The most recent monograph of the genus is by Janczewski, *Monographie des Groseilliers*, 1907 (originally published in *Mém. Soc. Phys. Nat. Hist. Genève*, 35:199-517, with 202 figs.), with important supplements in *Bull. Acad. Sci. Cracovic*, ser. B, 1910-13. The N. American species are treated by Coville & Britton in *North American Flora*, 22:193-225 (1908) under the two genera Ribes and Grossularia. There are also descriptions and figures of the more important species in Card's *Bush Fruits*, 444-84, figs. 80-109 (1911).

The currants and gooseberries are usually low, upright or less often procumbent deciduous, rarely evergreen shrubs with prickly or unarmed branches, small or medium-sized usually lobed leaves, with rather small solitary or racemose flowers often greenish or reddish and insignificant, but in some species white or brightly colored in shades of red, scarlet, orange or yellow; the fruits also are often attractive and either black, purple, scarlet, yellowish or greenish. The flowers appear in spring with the leaves, and the fruits ripen in June or July, but in *R. fasciculatum* they do not mature until September and remain on the branches all winter. Most species are hardy North except the evergreen ones; also *R. sanguineum*, *R. Roetzlii*, *R.*

Lobbii, *R. viscosissimum* are not quite hardy North. The tender *R. speciosum* with fuchsia-like bright red flowers is perhaps the most showy species of the genus, though also *R. sanguineum*, *R. odoratum*, *R. Gordonianum*, *R. Roetzlii*, *R. Lobbii*, *R. pinetorum*, *R. cereum*, *R. inebrians*, *R. niveum*, and others are handsome in bloom, while some, as *R. alpinum* and *R. fasciculatum*, have ornamental scarlet fruits. They are well adapted for borders of shrubberies and, particularly the procumbent kinds, for planting on slopes. *R. alpinum* is excellent for shady places and as undergrowth. *R. alpestre*, a strong-growing and very spiny gooseberry from western China, may prove valuable as a hedge-plant. Many species bear edible fruits; the most important are the domestic currant, *R. vulgare*, and the European gooseberry, *R. Grossularia*; of less importance are the black currant, *R. nigrum*, the Buffalo or Missouri currant, *R. odoratum*, the European *R. rubrum* and some of the American gooseberries, as *R. hirtellum*, *R. Cynosbati*, *R. oxyacanthoides*, *R. setosum*, *R. inerme*. These plants are mostly of easy cultivation; they grow in any moderately good loamy soil, the gooseberries preferring as a rule drier and sunnier positions, while the currants like more humidity and grow well in partly shaded situations. Propagation is by seeds which germinate readily; also by hardwood cuttings in autumn and by greenwood cuttings in summer under glass; mound-layering in summer is sometimes practised; budding or grafting is usually resorted to only, if quick propagation of rare varieties is desired. In Europe, currants and gooseberries are sometimes grafted high on *R. odoratum* trained to one stem, to form little standard trees. See also *Currant* and *Gooseberry* for cultivation.

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KEY TO THE SPECIES.

- A. Branches unarmed (or 2 small prickles below the lf. in No. 19): fls. usually in racemes; pedicels not jointed.
B. Fls. tubular, red, yellow or white.
C. Color of fls. yellow; fls. glabrous: les. convolute in bud.



3401. Flower of garden currant, to show structure. (X 4)

- D. Calyx-tube about twice as long as sepals; sepals revolute or spreading..... 1. *odoratum*
- DD. Calyx-tube 1-1½ times as long as sepals..... 2. *aureum*
- CC. Color of fls. red or white; lvs. plaited in bud.
- D. The fls. red or red and yellow, rarely white.
- E. Lvs. glabrous or nearly so beneath; fls. pale yellow and red..... 3. *Gordonianum*
- EE. Lvs. white-tomentose beneath; fls. red, rarely white..... 4. *sanguineum*
- DD. The fls. white, pink, or greenish; lvs. glabrous or pubescent and green beneath.
- E. Plants glandular-viscid; raceme short.
- F. Fr. black; calyx-tube cylindric-campanulate; lvs. 2-3 in. broad..... 5. *viscosissimum*
- FF. Fr. red; calyx-tube tubular; lvs. ½-1½ in. broad.
- G. Bracts of raceme cuneate-obovate, toothed; fls. white or whitish..... 6. *cereum*
- GG. Bracts rhombic, usually acute; fls. pink..... 7. *inebrians*
- EE. Plant not glandular-viscid; lvs. resinous-dotted beneath; racemes pendulous; fls. whitish; fr. black..... 8. *americanum*
- BB. Fls. saucer-shaped or open-campanulate, greenish or whitish.
- C. Lvs. resinous-dotted beneath.
- D. Racemes nodding, short; fls. broadly campanulate; lvs. 3-5-lobed..... 9. *nigrum*
- DD. Racemes upright, to 8 in. long; fls. rotate; lvs. 5-7-lobed..... 10. *bracteosum*
- CC. Lvs. not resinous-dotted.
- D. Habit decumbent.
- E. Ovary and fr. glandular; racemes erect..... 11. *glandulosum*
- EE. Ovary and fr. glabrous; racemes nodding..... 12. *triste*
- DD. Habit upright.
- E. Racemes drooping, many-fl.; fls. perfect; petiole 1½-3 in. long.
- F. Calyx-tube broadly campanulate; fls. purple, pink, or reddish..... 13. *petrum*
- FF. Calyx-tube saucer-shaped.
- G. Stamens as long as sepals; sepals reflexed..... 14. *multiflorum*
- GG. Stamens shorter than sepals; sepals spreading.
- H. Disk of fl. with a big narrow ring; anther-cells separated by a broad connective; lvs. cordate or subcordate..... 15. *vulgare*
- HH. Disk of fl. flat; anther-cells contiguous; lvs. usually truncate..... 16. *rubrum*
- EE. Racemes upright; fls. diacocious, small, greenish; petiole about 1 in. long or less.
- F. Branches always unarmed; lvs. truncate to subcordate.
- G. Pistillate fls. in 2-4-fl. fascicles; lvs. subchartaceous..... 17. *fasciculatum*
- GG. Pistillate fls. in dense racemes; lvs. thin..... 18. *alpinum*
- FF. Branches with slender paired prickles, sometimes unarmed; lvs. usually cuneate at the base..... 19. *diacantha*
- AA. Branches with prickles, rarely nearly unarmed; fls. 1-4 and pedicels jointed (except in No. 20).

- B. Fls. in racemes; sepals broader than long; sts. very bristly..... 20. *lacustre*
- BB. Fls. 1-4; sepals longer than broad.
- C. Color of fls. white or greenish suffused with purple.
- D. Sepals white (or greenish white in No. 23).
- E. Stamens as long as sepals or longer.
- F. Filaments villous; branchlets brown.
- G. Ovary glabrous; calyx-tube about as broad as long..... 21. *niveum*
- GG. Ovary glandular or pubescent; calyx-tube twice as broad as long..... 22. *curvatum*
- FF. Filaments glabrous; stamens nearly twice as long as the greenish white sepals; branches yellowish..... 23. *missouriense*
- EE. Stamens shorter than sepals; young branchlets usually very bristly.
- F. Peduncles scarcely exceeding the bud-scales; calyx-tube campanulate..... 24. *oxycanthoides*
- FF. Peduncles elongated; calyx-tube cylindric-campanulate..... 25. *setosum*
- DD. Sepals greenish, often tinged purplish.
- E. Lvs. cuneate or rounded at the base.
- F. Sepals about as long as tube; stamens as long, rarely longer than sepals..... 26. *hirtellum*
- FF. Sepals about twice as long as tube; stamens slightly exceeding the sepals..... 27. *rotundifolium*
- EE. Lvs. subcordate or occasionally rounded at the base.
- F. Petals spatulate or flabellate, less than half as long as sepals; style and calyx-tube inside pubescent.
- G. Fr. smooth or glandular-bristly.
- H. Ovary glabrous.
- I. Sepals longer than tube; stamens slightly longer than sepals..... 28. *divaricatum*
- II. Sepals shorter than tube; stamens slightly shorter than sepals..... 29. *inermis*
- HH. Ovary pubescent or glandular; stamens about half as long as sepals..... 30. *Grossularia*
- GG. Fr. prickly, not glandular, rarely smooth; stamens less than half as long as sepals..... 31. *Cynosbati*
- FF. Petals elliptic, more than half as long as sepals; style and calyx-tube inside glabrous..... 32. *alpestre*
- CC. Color of fls. orange, purple, or bright red.
- D. Fls. 5-merous.
- E. Stamens shorter than sepals; fr. prickly.
- F. Sepals glabrous outside, orange; anthers oval, yellow..... 33. *pinetorum*
- FF. Sepals pubescent outside, purple; anthers sagittate, purple..... 34. *Roezlii*
- EE. Stamens longer than the purplish red sepals..... 35. *Lobbii*
- DD. Fls. 4-merous, bright red; stamens 2-4 times as long as sepals..... 36. *speciosum*

Section 1. RIBES. Currants.

1. *odoratum*, Wendl. (*R. longiflorum*, Nutt. *R. fragrans*, Lodd. *R. palmatum*, Thory. *R. aureum*, Auth., not Pursh. *R. missouriense*, Hort. *Chrysobótrya revoluta*, Spach). MISSOURI CURRANT. BUFFALO CURRANT. GOLDEN CURRANT. Fig. 3402. Shrub, to 6 ft.: young



3402. Yellow-flowering currant.—*Ribes odoratum*. ($\times \frac{1}{2}$)

branchlets pubescent: lvs. ovate to orbicular-reniform, cuneate or truncate at the base, deeply 3-5-lobed and coarsely dentate, glabrate, 1-3 in. broad; petioles pubescent, shorter than blade; racemes 5-8-fld.; rachis pubescent; bracts ovate to oval, foliaceous; fls. yellow, fragrant; tube about $\frac{1}{2}$ in. long, stout; sepals oblong, scarcely half as long as tube, spreading or revolute; petals nearly half as long as sepals, more or less red; fr. globose or ovoid, about $\frac{1}{4}$ in. across, black. East of Rocky Mts., S. D. to Texas, east to Minn. and Ark. L.B.C. 16:1533. B.R. 125. L.D. 5:301. H.F. 1872:225 (as *R. Oregoni*).—A handsome shrub with yellow fragrant fls. appearing early in spring with the lvs. A form with large berries nearly $\frac{3}{4}$ in. diam. is sometimes cult. for its frs. as the Crandall.

2. *aureum*, Pursh (*R. tenuiflorum*, Lindl. *R. jasminiflorum*, Agardh. *Chrysobótrya intermedia* and *C. Lindleana*, Spach). Similar to the preceding species, but smaller and slenderer in every part: young shoots glabrous or pubescent: lvs. orbicular-reniform to obovate, 3-lobed and slightly crenate-dentate, cuneate to subcordate at the base, 1-2 in. broad, pubescent or glabrous; petioles about as long as the blades; racemes 5-15-fld.; bracts oblong to obovate; fls. yellow, fragrant or slightly fragrant; calyx-tube slender, $\frac{1}{4}$ - $\frac{1}{2}$ in. long or slightly longer; sepals $\frac{1}{2}$ to nearly $\frac{1}{2}$ in. long, spreading, upright in the faded fl.; petals shorter than half as long as sepals; fr. globose, red or black, $\frac{1}{4}$ - $\frac{1}{2}$ in. thick. Wash. to Calif., west to Assiniboia, Mont., Colo., and N. Mex. B.R. 1274. Var. *chrysococcum*, Rydb. Fr. yellow. Var. *leiobótrya*, Zabel (*R. leiobótrya*, Koehne). Quite glabrous, glandular while young; sepals recurved, calyx-tube longer.—The shrub cult. as *R. aureum* is usually the preceding species which has more showy and fragrant fls.

3. *Gordonianum*, Lem. (*R. Beatonii*, Hort. *R. Loudonii*, Hort. *R. odoratum* \times *R. sanguineum*). Intermediate between the parents. Habit of *R. odoratum*: lvs. usually 3-lobed, glabrous, truncate at the base; racemes about 20-fld.; fls. yellow, tinged red outside, somewhat glandular, sterile. Originated in England about 1840.—Hardier than the following species, though not quite so handsome in flower.

4. *sanguineum*, Pursh (*Calobótrya sanguinea*, Spach). Shrub, to 10 ft., more or less glandular and aromatic: branchlets pubes-

cent and glandular while young: lvs. cordate or nearly truncate, reniform-orbicular, 3-5-lobed with obtuse irregularly dentate lobes, dark green and puberulous above, whitish-tomentose beneath, 2-4 in. broad; petioles pubescent and glandular: racemes many-fld., pubescent and glandular; bracts oblanceolate; fls. red, pubescent; ovary glandular; calyx-tube about $\frac{1}{2}$ in.

long, sepals slightly longer; petals white or reddish; fr. blue-black, bloomy, slightly glandular. Brit. Col. to N. W. Calif. B.M. 3335. B.R. 1349. Gn. 51:208, fig. 1. H.U. 6:260.—Of this handsome shrub several varieties are in cult. Var. *atrórubens*, Loud. (var. *atrosanguineum*, Kirchn.). Var. *spléndens*, Barbier. Fls. dark blood-red, larger than those of the preceding variety. R.H. 1913:428. G. 35:363. Var. *carneum*, Dipp. (*R. carneum grandiflorum*, Carr.). Fls. pink. Var. *albescens*, Rehd. (*R. sanguineum* var. *albidum*, Hort., not Kirchn.). Fls. whitish. Gn. 51:208, fig. 2 (as *R. album*). G.M. 53:125. This variety is usually confused with *R. glutinosum* var. *albidum*, Jancz. (*R. albidum*, Paxt.), which differs chiefly in the glabrescent under side of the more deeply lobed and more sharply serrate lvs., in the more pendulous racemes with the pedicels $\frac{1}{4}$ - $\frac{1}{2}$ in. long, longer than the recurved narrower bracts. Var. *flóre-pléno*, Hort. With double red fls. P.M. 12:121. F.S. 1, p. 247. G.C. II. 14:144. Var. *Brocklebankii*, Bean. With yellow foliage. Gn. 78, p. 311.

5. *viscosissimum*, Pursh. Shrub, to 3 ft.: young growth and infl. glandular-pubescent and viscid: lvs. grayish green, reniform-orbicular, 5-lobed, with rounded crenately dentate lobes, glandular-pubescent on both sides, 2-3 in. broad; petioles shorter than blade, glandular-pubescent: fls. fragrant, greenish white or pinkish, in 3-8-fld. racemes; ovary glandular; tube cylindric-campanulate, about $\frac{1}{2}$ in. long; sepals about as long as tube; fr. black, not bloomy, glandular-hairy. Brit. Col. to Mont., Colo. and Calif.

6. *cereum*, Douglas. Much-branched, upright shrub, to 4 ft.: young growth puberulous and glandular: lvs. reniform-orbicular, 3-5-lobed with obtuse crenulate lobes, puberulous-glandular beneath, often glabrous or nearly so above, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. broad; racemes few-fld., pendulous; bracts cuneate-obovate, toothed at the rounded or truncate apex; fls. white or greenish; calyx-tube pubescent, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, sepals ovate, about as long; petals minute, orbicular; ovary glandular or smooth; style usually hairy above; fr. bright red, about $\frac{1}{2}$ in. across. Brit. Col. to Calif., east to Mont., Idaho, Utah, and Ariz. B.M. 3008. B.R. 1263.—Early leafing and conspicuous with its pale grayish green foliage studded with numerous white or pinkish fls.; also the bright red frs. are ornamental. Var. *farinósum* (var. *farinósum carneum*, Jancz.). Branchlets violet: lvs. whitish-pulverulent: fls. bright pink.

7. *inebrians*, Lindl. (*R. Spaethianum*, Koehne). Fig. 3403. Similar to the preceding species in habit and



3403. *Ribes inebrians*. ($\times \frac{3}{2}$)

foliage: racemes few-fl.; bracts rhombic, usually acute, entire or occasionally with a lateral lobe; fls. usually pink; style glabrous; ovary with stalked glands: fr. bright red, usually glandular. S. D. and Mont. to Nev., Cent. Calif., Ariz. and New Mex. B.R. 1471. B.B. (ed. 2) 2:238.—A hybrid between this and the preceding species is *R. Berlandieri*, Jancz.

8. *americanum*, Mill. (*R. flodidum*, L'Her. *R. pennsylvanicum*, Lam. *R. missouriense*, Hort.). AMERICAN BLACK CURRANT. Upright shrub, to 5 ft., with rather slender arching branches: young shoots slightly pubescent and glandular: lvs. suborbicular, cordate or nearly truncate, 3-5-lobed with acute, or sometimes obtuse, dentate lobes, more or less pubescent at least on the veins, resinous-dotted beneath, 1-3 in. broad: racemes pendulous, many-fl.; bracts linear to linear-lanceolate; fls. greenish white or yellowish; bracts longer than pedicels; ovary glabrous; tube cylindric-campanulate, $\frac{1}{6}$ in. long, sepals obtuse, slightly longer, pubescent; petals and stamens about two-thirds as long as sepals: fr. black, smooth. Nova Scotia to Va., west to Man. and Colo. G.O.H. 1. B.B. (ed. 2) 2:238.—Foliage with the peculiar heavy odor of the following species, turning crimson and yellow in autumn.

9. *nigrum*, Linn. EUROPEAN BLACK CURRANT. Upright shrub, to 6 ft., with rather stout branches, of strong disagreeable odor: lvs. suborbicular, cordate, 3-5-lobed, with broad, acutish irregularly serrate lobes, sparingly pubescent, resinous-dotted beneath, to 4 in. broad: racemes 5-10-fl.; bracts small, much shorter than the pedicels; ovary and calyx pubescent and glandular; calyx-tube broadly campanulate; sepals oblong, recurved; petals reddish or whitish, about half as long as sepals: fr. black, subglobose, $\frac{1}{8}$ - $\frac{3}{16}$ in. thick. Eu., N. and Cent. Asia, Himalayas. S.E.B. 4:523. R.F.G. 23:137.—Sometimes cult. for its fr. and escaped in the eastern and middle states. Var. *heterophyllum*, Pépin (var. *aconitifolium*, Kirchn., var. *crispum*, Hort., var. *laciniatum*, Lav.). With divided lvs., sometimes nearly to the base, the lobes irregularly and deeply incised. Var. *apiifolium*, Kirchn. (var. *dissectum*, Nichols.). Lvs. 3-parted, usually to the base, the lobes pinnatifid with narrow segms. Var. *xanthocarpum*, Späth (var. *fructu-luteo*, Hort.). Fr. yellow. Var. *chlorocarpum*, Späth (var. *fructu-viridi*, Hort.). Fr. greenish. Gt. 16:562, fig. 16. There are also forms with variegated lvs. as var. *variegatum*, Nichols., var. *marmoratum*, Mouillef., and var. *reticulatum*, Nichols.

10. *bracteosum*, Douglas. CALIFORNIAN BLACK CURRANT. Shrub, to 8 ft., with upright or ascending sts.: young growth sparingly pubescent and resinous-dotted: lvs. thin, cordate, deeply 5-7-lobed, with ovate to ovate-lanceolate, acute, sharply serrate lobes, 2-8 in. broad: racemes narrow, slender, upright, often 8 in. long; bracts spatulate, half as long as the pedicels, the lower foliaceous; fls. greenish or purplish; calyx-tube cup-shaped; sepals spreading, ovate-oblong, $\frac{1}{6}$ in. long; petals minute, obtuse: fr. globose, black with whitish bloom, resinous-dotted, edible. Alaska to N. Calif. B.M. 7419.—Hardy at the Arnold Arboretum; remarkable for its large maple-like lvs. and the long bracted racemes. A hybrid of this species with *R. nigrum* is *R. fuscescens*, Jancz. (*R. bracteosum* var. *fuscescens*, Jancz.); it differs chiefly in its reddish brown fls., in the small linear bracts of the spreading or arching infl., and in the larger fr. Gt. 55, p. 162. Originated in Scotland.

11. *glandulosum*, Grauer (*R. prostratum*, L'Her. *R. rigens*, Michx.). FETID CURRANT. SKUNK CURRANT. Decumbent shrub with prostrate or spreading and reclining sts. and ascending branches: young growth sparingly pubescent and sparingly glandular: lvs. thin, fetid, orbicular, cordate, deeply 5-7-lobed, with ovate-acute or acutish, doubly serrate lobes, glabrous above, pubescent on the veins beneath, $1\frac{1}{2}$ -3 in. broad:

racemes ascending, 8-12-fl.; pedicels filiform, glandular, much longer than the narrow bracts; fls. whitish or pinkish; ovary glandular-hispid; calyx-tube cup-shaped; sepals short, spreading, glabrous outside: fr. red, glandular-bristly. Newfoundland to Brit. Col.; south to Mich. and Minn. and in the mountains to N. C. B.B. (ed. 2) 2:238.

12. *triste*, Pall. SWAMP RED CURRANT. Low shrub with creeping or ascending, often rooting sts.: young growth sparingly pubescent and sparingly glandular: lvs. thin, suborbicular, 3-5-lobed, with acute or obtuse, coarsely serrate lobes, dark green and glabrous above, pubescent or whitish-tomentose beneath, 2-4 in. broad: racemes drooping, $1\frac{1}{2}$ - $3\frac{1}{2}$ in. long; pedicels longer than the ovate bracts; fls. purplish; calyx-tube saucer-shaped; sepals spreading, obtuse; petals reddish: fr. red, smooth. N. Asia and boreal N. Amer., south to Maine and Vt. B.B. (ed. 2) 2:237. Var. *albinervium*, Fern. (*R. albinervium*, Michx.). Lvs. glabrous or nearly so beneath. N. Amer., south to N. H., Mich. and Wis.

13. *petraeum*, Wulf. (*R. bullatum*, Otto and Dietr.). Upright shrub, to 8 ft.: branches usually glabrous: lvs. roundish, subcordate or truncate, usually 3-lobed, with acutish lobes, rugose, pubescent beneath, 3-4 in. broad: racemes dense, to 4 in. long; fls. red or pink; pedicels short; bracts very small; calyx-tube broadly campanulate with short spreading rounded ciliate sepals; petals nearly half as long as sepals, with a callosity below the base: fr. dark red, acid. Mts. of Cent. and S. Eu., Caucasus, N. Asia. R.F.G. 23:138. Var. *carpathicum*, Jancz. (*R. carpathicum*, Kit.). Lvs. usually 3-lobed, rugose, glabrescent: racemes looser and smaller. Carpathian Mts. Var. *Biebersteinii*, Jancz. (*R. Biebersteinii*, Berl. *R. caucasicum*, Bieb. *R. macrobotrys*, Hort.). Lvs. usually 5-lobed, with short obtuse lobes, cordate, not rugose, glabrescent or pubescent: racemes long; fls. reddish: fr. red or blackish purple. Caucasus. Var. *atropurpureum*, Jancz. (*R. atropurpureum*, C. A. Mey.). Lvs. subcordate or truncate, usually 3-lobed, with acutish lobes, not rugose, glabrescent or pubescent beneath, to 6 in. broad: racemes short; fls. purple; the disk inside without callosities: fr. red or blackish purple. Siberia.

14. *multiflorum*, Kit. Upright shrub with stout branches: winter buds large: lvs. roundish, subcordate or truncate, 3-5-lobed with acutish or obtusish, crenately dentate lobes, pubescent beneath, to 4 in. broad: racemes pendulous, dense, to 6 in. long, sometimes about 50-fl.; pedicels short; fls. greenish yellow; calyx-tube saucer-shaped; sepals reflexed; petals minute;



3404. *Ribes vulgare*.—The common currant. (Natural size.) No. 15.

stamens and style equaling the sepals: fr. dark red, smooth. S. Eu. B.M. 2368. L.B.C. 14:1331. R.F.G. 23:138a. L.I. 31.

15. *vulgare*, Lam. (*R. hortense*, Hedl. *R. sativum*, Syme. *R. rubrum* of many authors, not Linn.). RED or GARDEN CURRANTS. Fig. 3404. Upright shrub, to 5 ft.: young growth pubescent and slightly glandular: lvs. thin, cordate or subcordate, 3-5-lobed, with short-ovate, acutish, serrate lobes, pubescent at least on the veins beneath, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. broad: racemes drooping, many-fld., glabrous or nearly so; pedicels filiform, much longer than the ovate bracts; calyx-tube saucer-shaped, green or slightly purple inside between the stamens and the style with an elevated slightly 5-angled ring; anthers with a broad connective separating the cells: fr. red, whitish, or striped, juicy, the dried remnants of the fl. 5-angled at the base. W. Eu. S.E.B. 4:520. B.B. (ed. 2) 2:237. Var. *macrocarpum*, Jancz. (*R. acerifolium*, Hort.). Of irregular habit on account of the lateral branchlets being partly without buds: lvs. large, deeply cordate, 3-lobed, with a very large middle lobe: racemes without lvs. at the base: fr. large, always red. To this variety belong most of the large-fruited "cherry currants," tenderer than the typical form. *R. vulgare* is the parent of most of the cult. currants. Some of the harder and smaller-fruited varieties are probably crosses with the harder *R. rubrum*; they have been named *R. Houghtonianum*, Jancz. Other hybrids of this species are *R. Goudotii*, Jancz. (*R. vulgare* \times *R. petraeum*). *R. Koehneanum*, Jancz. (*R. vulgare* \times *R. multiflorum*) and *R. fulurum*, Jancz. (*R. vulgare* \times *R. Warscewiczii*).

16. *rubrum*, Linn. (*R. Schlechtendalii*, Lange. *R. sylvestre*, Syme. *R. scandicum*, Hedl.). NORTHERN RED CURRANT. Shrub, to 6 ft.: young growth usually glabrous: lvs. truncate, rarely subcordate, 3-5-lobed, usually nearly glabrous, to 5 in. across: racemes usually spreading; pedicels short; bracts very small; fls. greenish or brownish; calyx-tube saucer-shaped, without prominent ring inside; anthers with contiguous cells: fr. usually red, juicy, the dried remnants of the fl. circular at the base. Cent. and N. Eu. N. Asia. S.E.B. 4:522. Var. *pubescens*, Swartz. Young shoots slightly pubescent: lvs. pubescent beneath: racemes shorter; fls. brown or pinkish: fr. small. N. Eu. Var. *glabellum*, Trautv. & Mey. Young branchlets and lvs. glabrous: fls. larger, pink or brownish red: fr. larger. N. Asia.—*R. rubrum* is rare in cult. outside of the gardens of N. Eu. where forms with red, pink or whitish frs. are grown. Besides *R. Houghtonianum*, mentioned under the preceding species, two other crosses of *R. rubrum* are known: *R. pallidum*, Otto. & Dietr. (*R. rubrum* \times *R. petraeum*), and *R. holosericeum*, Otto & Dietr. (*R. rubrum* \times *R. petraeum* var. *caucasicum*).

17. *fasciculatum*, Sieb. & Zucc. (*R. japonicum*, Carr., not Maxim. *R. alpinum japonicum*, Nichols.). Shrub, to 4 ft., with upright or ascending branches: lvs. subchartaceous, truncate to cordate, 3-5-lobed, with obtusish lobes, glabrous or slightly pubescent, to 5 in. across: fls. dioecious, small, greenish; male fls. in 4-9-fld. clusters, pistillate fls. 2-4; calyx-tube cup-shaped; anthers subsessile: fr. subglobose, scarlet, glabrous, $\frac{1}{2}$ in. across, insipid. April, May; fr. in Sept., Oct. Japan. Var. *chinense*, Maxim. (*R. Billiardii*, Carr.). Lvs. larger, persisting until the beginning of the winter, lobes more acutish, pubescent beneath like the petioles and young branchlets. N. China. S.T.S. 1:38. M.D.G. 1899:571.—Handsome shrub chiefly valued for its late persisting foliage and the bright scarlet berries remaining on the branches during the whole winter.

18. *alpinum*, Linn. (*R. opulifolium*, Hort.). ALPINE CURRANT. Dense shrub, attaining 8 ft. and as much or more through, with upright sts. and spreading branches, nearly glabrous: lvs. truncate or subcordate, 3-lobed, rarely 5-lobed, with obtuse or acutish dentate lobes,

1-2 in. across: fls. dioecious, small, greenish, in upright racemes, the male 1-2 $\frac{1}{2}$, the female $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long; the calyx-tube nearly flat; sepals ovate, petals minute; filaments very short: fr. subglobose, scarlet, glabrous, insipid. Eu. L.B.C. 15:1486. S.E.B. 4:519. R.F.G. 23:135.—Several named varieties of little importance are known; the best known are: Var. *pumilum*, Lindl. (var. *humile*, A. Braun). Dwarf form with smaller lvs. Var. *laciniatum*, Kirchn. Lvs. more deeply lobed and incisedly toothed. Var. *aureum*, Bean (var. *pumilum aureum*, Pynaert, var. *foliis-aureis*, Hort.). Dwarf form with yellowish foliage. R.B. 4:233. The pistillate fruiting form is sometimes distinguished as var. *bacciferum*, Loud., and the staminate sterile form as var. *sterile*, Loud.—The Alpine currant is a desirable shrub of dense habit, unfolding very early its bright green foliage, adorned in summer and autumn with bright scarlet berries; it is one of the best shrubs to plant as undergrowth and in shady places.

19. *diacantha*, Pall. (*R. saxatile*, Pall.). Upright shrub, to 6 ft.: branches glabrous, slender, upright, with paired small slender prickles at the nodes or unarmed: lvs. oval or cuneate-obovate, 3-lobed with sparingly dentate, obtusish lobes, glabrous, lustrous, with obsolete veins, $\frac{3}{4}$ -1 $\frac{3}{4}$ in. long; petioles about $\frac{1}{2}$ in. long: fls. dioecious, small, greenish, in upright racemes, the staminate about 1 $\frac{1}{4}$ in. long, the pistillate $\frac{1}{2}$ - $\frac{3}{4}$ in. long; calyx-tube flat; sepals oval, petals minute: fr. subglobose or somewhat ovoid, scarlet. N. Asia.—Like the preceding species desirable for its bright green more lustrous foliage and for its scarlet fr., but habit upright, not spreading.

20. *lacustre*, Poir. SWAMP BLACK CURRANT, or SWAMP GOOSEBERRY. Shrub with slender weak sts., usually densely bristly; prickles slender, often clustered: lvs. nearly orbicular, cordate, deeply 3-7-lobed, with acutish, incisedly dentate lobes, glabrous or nearly so, 1 $\frac{1}{4}$ -2 in. across: racemes spreading or drooping, 10-15-fld.; fls. greenish or purplish; calyx-tube saucer-shaped; sepals spreading, broad and short; stamens very short: fr. subglobose, purple-black, with gland-tipped bristles. Newfoundland to Alaska, south to Mass., Mich., Minn., Colo., and Calif. L.B.C. 9:884. B.M. 6492.

Section 2. GROSSULARIA. Gooseberries.

21. *niveum*, Lindl. (*Grossularia nivea*, Spach). Shrub, to 8 ft., upright or ascending: branches reddish brown, with stout brown prickles $\frac{1}{2}$ - $\frac{3}{4}$ in. long, without bristles: lvs. suborbicular, thin, 3-5-lobed, with



3405. *Ribes hirtellum*.—Parent of some of the American garden gooseberries. ($\times \frac{1}{2}$)

few-toothed obtusish lobes, sparingly pubescent or glabrous, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long; fls. 1-4, white, on slender peduncles; bracts ovate, small, much shorter than the filiform pedicels; ovary glabrous; tube campanulate, sepals narrowly lanceolate, $\frac{1}{4}$ - $\frac{1}{3}$ in. long; stamens slightly longer than the sepals, with pubescent fila-

ments: fr. globose, bluish black, glabrous, subacid. Idaho and Wash. to Nev. B.R. 1962.—Attractive in bloom with its numerous white fls.

22. *curvatum*, Small (*Grossularia curvata*, Cov. & Brit.). Diffusely branched shrub, to 3 ft., with slender reddish brown or purplish branches, spines slender, about $\frac{1}{4}$ in. long; lvs. suborbicular, cuneate to subcordate, with obtusish, toothed lobes, sparingly pubescent, $\frac{1}{2}$ –1 in. across; fls. 1–5, white, on slender peduncles; bracts ovate, often 3-lobed, ciliate, much shorter than the slender pedicels; ovary glandular or pubescent; tube broadly campanulate; sepals linear-spatulate, about $\frac{1}{4}$ in. long, revolute; petals small, lanceolate, toothed; stamens conspicuous, as long as the sepals, with villous filaments; fr. globose, greenish, $\frac{1}{4}$ – $\frac{1}{2}$ in. across, glabrous. Ga. to La. and Texas.—Graceful little shrub, similar to the preceding species, but slenderer and more spreading; perfectly hardy at the Arnold Arboretum.

23. *missouriense*, Nutt. (*R. gracile* Pursh, not Michx. *R. rotundifolium*, Jancz., not Michx. *Grossularia missouriensis*, Cov. & Brit.). Shrub, to 6 ft., with smooth or sometimes bristly, grayish or whitish branches; spines about $\frac{1}{4}$ in. long or shorter; lvs. suborbicular, broadly cuneate to subcordate at the base, 3–5-lobed, with coarsely dentate obtusish lobes, pubescent beneath, $\frac{3}{4}$ –2 $\frac{1}{2}$ in. broad; fls. greenish white, 2–3, on slender peduncles $\frac{1}{2}$ – $\frac{3}{4}$ in. long; pedicels slender, much longer than the bracts; ovary glabrous; calyx-tube cylindric-campanulate; sepals linear, about $\frac{1}{4}$ in. long; filaments glabrous, nearly twice as long as sepals; style pubescent below; fr. globose, $\frac{1}{4}$ – $\frac{1}{2}$ in. across, purplish, glabrous, subacid. Ill. to Minn., S. D., Kans., Mo. and Tenn. B.B. (ed. 2) 2:240.

24. *oxyacanthoides*, Linn. (*Grossularia oxyacanthoides*, Mill.). Low shrub with slender, often reclining branches, usually more or less bristly and with spines about $\frac{1}{2}$ in. long, sometimes nearly wanting; lvs. suborbicular, cordate to broadly cuneate at the base, deeply 5-lobed with dentate lobes, slightly pubescent or nearly glabrous, 1–2 in. broad; peduncles very short, scarcely exceeding the bud-scales, 1–2-fl.; pedicels short; fls. greenish white; sepals narrow-oblong, little longer than the tube; stamens somewhat shorter than the sepals; fr. globose, smooth, red, slightly bloomy, edible. Newfoundland to Brit. Col., south to Mont., N. D., and Mich. B.B. (ed. 2) 2:240.—The plant cult. as *R. oxyacanthoides* is usually *R. hirtellum* or *R. inerme*.

25. *setosum*, Lindl. (*R. saximontanum*, E. Nelson. *Grossularia setosa*, Cov. & Brit.). Shrub, to 3 ft., with reddish brown usually bristly branches; spines subulate, $\frac{3}{4}$ in. or less long; lvs. suborbicular, cordate to truncate, rarely broadly cuneate, 3–5-lobed, with dentate lobes, finely pubescent and usually somewhat glandular, $\frac{1}{2}$ –1 $\frac{1}{2}$ in. wide; fls. 1–4, white; calyx-tube cylindric-campanulate, glabrous, about twice as long as the sepals; petals half or two-thirds as long as the sepals, as long as the stamens; style pubescent below; fr. red to black, glabrous or somewhat bristly. Idaho to Assiniboia, S. D., and Wyo. B.R. 1237. B.B. (ed. 2) 2:240.

26. *hirtellum*, Michx. (*R. saxosum*, Hook. *R. gracile*, Jancz., not Michx. *R. oxyacanthoides* of many authors, not Linn. *Grossularia hirtella*, Spach). Fig. 3405. Shrub, to 4 ft., with slender branches, usually unarmed, sometimes with subulate small spines, only at the base of vigorous shoots bristly; lvs. suborbicular, usually cuneate, incisedly 3–5-lobed, with dentate, acute lobes, glabrous or sparingly pubescent, 1–2 in. broad; petioles often with long hairs; fls. 1–3, greenish; bracts much shorter than pedicels; ovary glabrous, rarely with stalked glands; calyx-tube narrow-campanulate; sepals oblong, often purplish, glabrous; stamens as long as sepals, petals half as long; style pubescent; fr. globose, smooth or rarely with stalked glands, purple or black,

edible. Newfoundland to Pa. and W. Va., west to Man. and S. D. B.M. 6892 (as *R. oxyacanthoides*). B.B. (ed. 2) 2:241.—This is the most important of the edible American gooseberries and there are in cult. several hybrids with *R. Grossularia*, designated as *R. rusticum*, Jancz., to which such varieties as Downing,



3406. *Ribes cynosbati*. ($\times \frac{1}{4}$)

Houghton, and Smith are thought to belong, while Pale Red appears to be of pure *R. hirtellum* parentage.

27. *rotundifolium*, Michx. (*R. triflorum*, Willd. *Grossularia rotundifolia*, Cov. & Brit.). Shrub, to 3 ft., with slender brown branches, or the younger ones gray; spines small, sparse, rarely over $\frac{1}{4}$ in. long; lvs. suborbicular, broadly cuneate to subcordate at the base, usually 3-lobed, with coarsely dentate obtusish lobes, minutely pubescent or nearly glabrous, 1–2 in. broad; fls. 1–3, purplish; peduncles slender; pedicels much longer than the small bracts; fls. greenish purple; calyx-tube campanulate; sepals linear, about twice as long as tube; petals obovate; stamens somewhat longer than the sepals; fr. globose, smooth, purplish. L.B.C. 11:1094. G.O.H. 3. B.B. (ed. 2) 2:241.—This species is rare in gardens; usually the following species is cult. under this name.

28. *divaricatum*, Douglas (*R. divaricatum* var. *Douglasii*, Jancz. *R. irriguum*, Koehne, not Douglas. *Grossularia divaricata*, Cov. & Brit.). Shrub, to 10 ft.; branches gray to brown, with stout spines $\frac{1}{2}$ – $\frac{3}{4}$ in. long, sometimes unarmed and sometimes bristly; lvs. suborbicular, cordate to subtruncate, usually 5-lobed, with coarsely crenate-dentate obtusish lobes, pubescent beneath along the veins or glabrous, 1–2 $\frac{1}{2}$ in. broad; fls. 2–4, greenish purple; peduncles slender; bracts ovate, small; ovary glabrous; calyx-tube campanulate; sepals oblong, longer than tube; stamens slightly longer than the sepals; fr. globose, smooth, black or dark purple. Brit. Col. to Calif. B.R. 1359. Var. *pubiflorum*, Koehne (*R. divaricatum* var. *villosum*, Zabel). Lvs. pubescent; fls. smaller; vigorous sts. bristly. Var. *montanum*, Jancz. Low shrub with almost prostrate branches, smaller in every part. Calif.

29. *inerme*, Rydb. (*R. hirtellum Purpusii*, Koehne. *R. oxyacanthoides* var. *nevadense* and var. *irriguum*, Jancz. *Grossularia inermis*, Cov. & Brit.). Shrub, to 6 ft.; branches with few small spines less than $\frac{1}{2}$ in. long, sometimes unarmed, rarely with a few bristles; lvs. suborbicular, cordate to truncate at the base, 3–5-lobed with crenate-dentate obtusish lobes, glabrous or sometimes pubescent, $\frac{1}{2}$ –2 $\frac{1}{2}$ in. broad; fls. 1–4, green or purplish; bracts small; ovary glabrous; calyx-tube narrowly campanulate; sepals oblong, slightly shorter than tube; stamens shorter than sepals; fr. purplish red, smooth, edible. Mont. to Brit. Col. to Calif. and New Mex.

30. *Grossularia*, Linn. (*Grossularia reclinata*, Mill.). Shrub, to 3 ft.; branches ascending or reclining, with stout spines, about $\frac{1}{2}$ in. long, mostly in 3's, st. sometimes bristly; lvs. suborbicular, cordate to broadly

cuneate, 3-5-lobed with crenulate-dentate, obtusish lobes, pubescent or glabrous, $\frac{3}{4}$ -2 $\frac{1}{2}$ in. broad: fls. 1-2, greenish; bracts small; ovary pubescent and often glandular; calyx-tube short-campanulate, about as long as the usually pubescent reflexed sepals; stamens shorter than sepals; style pubescent: fr. globose to ovoid, usually pubescent and glandular-bristly. Eu., N. Afr., Caucasus. S.E.B. 4:518. R.F.G. 23:134. Var. *Ūva-crispa*, Smith (var. *pubescens*, W. D. Koch. *R. Ūva-crispa*, Linn.). Low shrub: lvs. smaller, pubescent: ovary pubescent, not glandular: fr. very small, yellowish, pubescent. Var. *reclinatum*, Berl. (var. *glabrum*, W. D. Koch. *R. reclinatum*, Linn.). Lvs., calyx and fr. glabrous.—This species is the parent of the European gooseberries.

31. *Cynósbati*, Linn. (*R. grácle*, Michx. *Grossulária Cynósbati*, Mill.). Fig. 3406. Shrub, to 5 ft., but usually lower, with spreading branches: spines slender, 1-3, $\frac{1}{4}$ - $\frac{3}{8}$ in. long: bristles few and weak or none: lvs. orbicular, truncate or cordate, deeply 3-5-lobed, with crenately or incisely dentate lobes, usually pubescent beneath, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. broad: fls. 1-3, on slender stalks, green, ovary setose; calyx-tube broadly campanulate; sepals shorter than tube; petals about half as long; stamens little longer than petals: fr. globose or ovoid, vinous-red, prickly, edible. New Bruns. to N. C., west to Man., Mo. and Ala. B.B. (ed. 2) 2:239. Var. *inérme*, Rehd. Fr. without prickles, smooth. Var. *glabrátum*, Fern. Lvs. glabrous or only sparingly pilose on the veins.

32. *alpéstre*, Decne. Upright shrub, to 10 ft.: branches with stout spines to $\frac{3}{4}$ in. long and usually in 3's, often bristly: lvs. cordate to truncate, 3-5-lobed, with incisely dentate, obtusish lobes, 1-2 in. broad: fls. 1-2, short-peduncled, greenish or sometimes reddish;

far north as Mass.; in W. China, E. H. Wilson found hedges 6-8 ft. high so thick and spiny that a yak, an animal as strong as an ox, could not break through them.

33. *pinetòrum*, Greene (*Grossulária pinetòrum*, Cov. & Brit.). Shrub, to 6 ft., with spreading and reclining branches, without bristles: spines 1-3, $\frac{1}{2}$ in. long or less: lvs. suborbicular, thin, cordate, usually 5-cleft, with obtuse irregularly incised-dentate lobes, dull green and glabrous above, puberulous beneath at least on the veins, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. broad: fls. solitary, orange-red; bracts small, ciliate; ovary bristly; calyx-tube campanulate, pilose; sepals spatulate, reflexed, nearly twice as long as tube; petals orange, only one-third shorter than the sepals; stamens as long as petals: fr. globose, prickly, purple. Ariz., New Mex.—Hardy at the Arnold Arboretum; very striking on account of the unusual orange-red color of the fls.

34. *Roëzlii*, Regel (*R. amictum*, Greene. *R. áridum*, Greene. *R. Wilsonianum*, Greene. *Grossulária Roëzlii*, Cov. & Brit.). Shrub, to 5 ft., with pubescent branchlets; bristles wanting; spines slender, about $\frac{1}{2}$ in. long: lvs. thin, reniform-orbicular, truncate or subcordate, 3-5-lobed with incisely crenate-dentate lobes, finely pubescent on both sides or glabrous above, $\frac{1}{2}$ -1 in. broad: fls. 1-3, purple; bracts longer or sometimes shorter than pedicels; ovary bristly and usually white-hairy; calyx-tube cylindric-campanulate, pubescent; sepals lanceolate, longer than tube; petals white or pinkish, nearly half as long as sepals; stamens slightly longer than sepals; anthers sagittate: fr. globose, prickly, purple. Cent. and S. Calif. Gt. 28:982, figs. 1-3. R.H. 1899, p. 177. Var. *crúentum*, Rehd. (*R. crúentum*, Greene. *R. amictum* var. *crúentum*, Jancz.). Lvs. and fls. glabrous. Ore. to Cent. Calif. B.M. 8105.



3407. *Ribes Lobbii*. (Natural size.)

calyx-tube campanulate, glandular; sepals oblong, reflexed, about as long as tube; petals white, elliptic, at least half as long as sepals; ovary with gland-tipped bristly hairs: fr. globose or ovoid, to $\frac{3}{8}$ in. long, with gland-tipped bristles. Himalayas, W. China. Var. *gigantèum*, Jancz. Shrub, to 15 ft. with stout spines over 1 in. long: fls. glabrous, with smooth ovary: fr. larger, smooth, green. W. China.—*R. alpestre* may prove to be a desirable hedge-plant, hardy at least as

R.H. 1908, p. 32.—Very handsome in fl., particularly on account of the contrast between the purple calyx and the white petals.

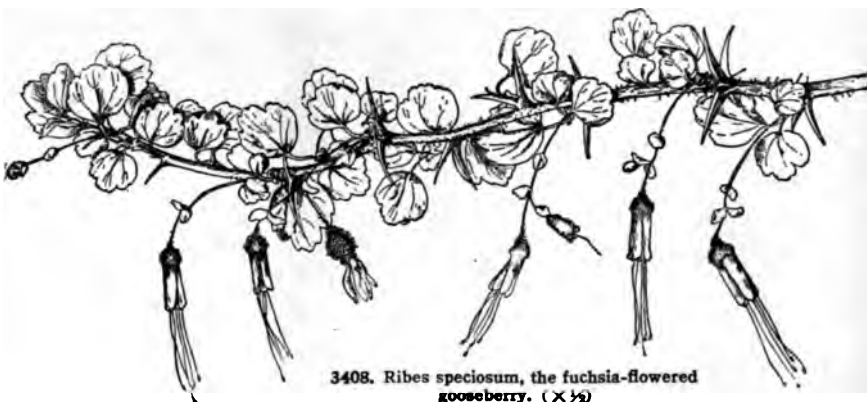
35. *Lóbbii*, Gray (*Grossulária Lóbbii*, Cov. & Brit.). Fig. 3407. Shrub, to 6 ft.; branchlets pubescent, rarely with a few bristles; spines 3, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: lvs. thin, suborbicular, cordate or subcordate, 3-5-lobed, with crenate-dentate obtuse lobes, sparingly pubescent when young and glandular, or glabrous above, $\frac{3}{4}$ -1 $\frac{1}{2}$ in.

broad: fls. 1-2, purple-red, rather large; peduncles glandular-pubescent; bracts ovate, as long as pedicels or shorter; ovary stipitate, glandular; calyx-tube narrow-campanulate, finely pubescent; sepals reflexed, 2-3 times as long as the tube; petals whitish, half as long as sepals; stamens twice as long as petals; anthers oblong, glandular on back: fr. ovoid, purple, densely glandular. Brit. Col. to N. Calif. B.M. 4931 (as *R. subvestitum*). R.H. 1903, p. 30. G.C. II. 19:11.

36. *speciosum*, Pursh (*R. fuchsoides*, Moc. & Sessé. *Grossularia speciosa*, Cov. & Brit.). Fig. 3408. Evergreen shrub, to 12 ft., with stout sts.; branches usually bristly; spines 3, stout, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: lvs. coriaceous, orbicular to obovate, rounded to broadly cuneate, 3-5-lobed or crenate-dentate, glabrous or sparingly glandular-hairy, lustrous above, $\frac{1}{2}$ - $1\frac{1}{2}$ in. long: fls. 2-4, bright red, on slender pendulous peduncles, 4-merous; tube broadly campanulate; sepals upright, parallel, about $\frac{1}{2}$ in. long, about as long as the scarlet convolute petals; stamens 2-4 times as long as petals: fr. ovoid, glandular-bristly, red. Calif. B.R. 1557. B.M. 3530. Gn. 9, p. 586; 31, p. 333; 34, p. 230. G.C. III. 34:71. R.H. 1900:98; 1908, p. 29. J.H. III. 54:207.—One of the most showy gooseberries, but not hardy North.

R. aciculare, Smith. Allied to *R. Grossularia*. Spiny shrub: branches slender, bristly: lvs. 3-5-lobed, usually glabrous, about 1 in. broad: fls. pinkish; sepals reflexed; style glabrous: fr. smooth, rarely hispid, red or greenish yellow. Cent. Siberia, Altai Mts. The earliest gooseberry to burst into leaf.—*R. affine*, Douglas.—*R. laxiflorum*.—*R. albidum*, Paxt.—*R. glutinosum albidum*.—*R. ambiguum*, Maxim. Low unarmed shrub: lvs. roundish, 3-5-lobed, with short, obtuse lobes, viscid-glandular beneath, to 2 in. broad: fls. 1-2, greenish, tube saucer-shaped; stamens shorter than sepals: fr. green, glandular-bristly. Japan.—*R. ambiguum*, Wats.—*R. Watsonianum*.—*R. burejense*, F. Schmidt. Allied to *R. alpestre*. Spiny and bristly shrub, to 3 ft.: lvs. deeply 3-5-lobed, pubescent and glandular, to 2 in. broad: fls. 1-2, reddish brown or pale: fr. greenish, prickly. N. E. Asia.—*R. californicum*, Hook. & Arn.—*R. occidentale*.—*R. Carrerei*, Schneid. (*R. intermedium*, Carr., not Tausch. *R. glutinosum albidum* \times *R. nigrum*). Intermediate between the parents: lvs. without the odor of *R. nigrum*: fls. pink, glandular, in horizontal racemes to 3 in. long: fr. black, not bloomy. Originated with Billiard at Fontenay-aux-Roses, France.—*R. cognatum*, Greene (*R. palouense*, Elmer). Allied to *R. oxyacanthoides*. Spiny shrub to 10 ft., sometimes without bristles: fls. 2-5, white or whitish; calyx-tube cylindric, longer than sepals; stamens about half as long as sepals: fr. smooth. Wash., Ore.—*R. coloradense*, Cov. (*R. laxiflorum* var. *coloradense*, Janca.). Allied to *R. glandulosum*. Unarmed procumbent shrub: lvs. usually 5-lobed: sepals longer, glandular-pubescent outside: fr. black, not bloomy. Colo.—*R. Culcervellii*, Macfarlane (*R. Schneideri*, Maurer. *R. nigrum* \times *R. Grossularia*). Unarmed shrub: fls. similar to those of *R. nigrum*: the glandless lvs. and the infl. resembling those of the gooseberry: fr. dark red, hairy. G.C. III. 12:271; 44:120. J.H.S. 28, pp. 169-73. Originated in England and afterward also in Germany. Var. *wollense* (*R. wollense*, Bean). Lvs. with a few glands beneath: fr. glabrous, shining black.—*R. dikuscha*, Fisch. Allied to *R. bracteosum*. Unarmed shrub: lvs. 3-5-lobed, glabrous, glandular beneath, to 5 in. broad: fls. white, tomentose, in upright racemes to 3 in. long: bracts linear, small: fr. bluish black, slightly bloomy. E. Siberia.—*R. erythrospermum*, Cov. & Leiber. Allied to *R. glandulosum*. Unarmed prostrate shrub: lvs. deeply 3-5-lobed, finely pubescent and glandular: racemes erect, 6-10-fld.; bracts about as long as pedicels: fls. yellow or salmon-colored: fr. glandular-hairy, scarlet. Ore. G.F. 10:184.—*R. fontenayense*, Janca. (*R. sanguineum fontenayense*, Hort. *R. Grossularia* \times *R. sanguineum*). Intermediate between the parents: unarmed shrub: lvs. subcoriaceous, pubescent beneath: racemes horizontal or pendulous, stalked, 3-6-fld.: fls. vinous-red, pubescent: fr. purplish black. Originated in France with Billiard at Fontenay-aux-Roses.—*R. fulvum*, Janca. (*R. vulgare* \times *R. Warscewiczii*). Intermediate between the parents: fls. brownish red or pinkish: fr. dark red. Raised by Jancazewski at Lemberg, Galicia.—*R. Gaydum*, Steud. (*R. villosum*, Gay, not Nutt. *R. trilobum*, Mey.). Evergreen unarmed shrub, to 4 ft., with pubescent branches: lvs. slightly 3-lobed, pubescent, 1-2 in. across: fls. dioecious, yellow, honey-

scented, in erect dense pubescent racemes 1-2 in. long: fr. purple-black, hairy. Chile. B.M. 7611. Not hardy North.—*R. Giraldii*, Janca. Allied to *R. diacantha*. Spiny shrub, to 2 ft., with spreading bristly branches: lvs. 3-5-lobed, the middle lobe longer, pubescent and glandular, about $1\frac{1}{2}$ in. broad: fls. dioecious, brownish, in upright racemes: fr. scarlet, glandular-bristly. N. W. China.—*R. glaciale*, Wall. Allied to *R. alpinum*. Unarmed shrub, to 15 ft.: lvs. cordate to truncate, 3-5-lobed, the middle lobe elongated,



acute or acuminate, glandular, to $2\frac{1}{2}$ in. long: fls. dioecious, greenish white or purplish, in upright racemes: fr. glabrous, scarlet, finally black. Himalayas, W. China.—*R. glutinosum*, Benth. (*R. sanguineum* var. *glutinosum*, Loud.). Allied to *R. sanguineum*. Unarmed shrub, to 12 ft., with glandular-viscid pubescence: lvs. cordate, 3-5-lobed, glandular beneath, otherwise nearly glabrous, to 4 in. broad: racemes pendulous, to 4 in. long; bracts recurved; fls. pink-carmine: fr. black, glandular-hairy. Calif. Var. *albidum*, Janca. (*R. sanguineum albidum*, Kirchn. *R. albidum*, Paxt.). Fls. white, tinged pinkish, often confused with *R. sanguineum* var. *albescens*, which see.—*R. Henryi*, Franch. Evergreen unarmed shrub, glandular: lvs. elliptic, crenulate, to 4 in. long: fls. dioecious, small, greenish; pistillate racemes 7-9-fld., with large green bracts: fr. oblong, green, glandular. Cent. China.—*R. himalayense*, Decne. Allied to *R. petraeum*. Unarmed shrub, to 12 ft.: lvs. cordate, 3-5-lobed, with acute or obtusish lobes, glandular above, pubescent or glabrous beneath, to 5 in. broad: fls. greenish, tinged purple, in racemes to 5 in. long, broadly campanulate: fr. red or black. Himalayas, W. China.—*R. Hudsonianum*, Rich. Allied to *R. bracteosum*. Unarmed shrub: lvs. 3-5-lobed, resinous-dotted beneath, $1\frac{1}{2}$ -4 in. broad: fls. white, in loose racemes about 2 in. long; bracts setaceous, as long as the pedicel: fr. black, smooth. Hudson Bay to Alaska, south to N. Minn. B.B. (ed. 2) 2:237.—*R. integrifolium*, Philippi. Evergreen unarmed shrub, to 3 ft.: lvs. coriaceous, lanceolate, dentate above the middle, glabrous, 1-1 $\frac{1}{2}$ in. long: fls. dioecious, yellow, in pendent racemes $\frac{1}{2}$ - $1\frac{1}{4}$ in. long: fr. small, purplish black. Chile; not hardy North. Gt. 30:1047.—*R. irriguum*, Douglas. Allied to *R. oxyacanthoides*. Spiny shrub, to 10 ft., usually without bristles: lvs. 3-5-lobed, 1-2 $\frac{1}{2}$ in. broad: fls. whitish, the peduncle exceeding the bud-scales; sepals nearly twice as long as tube; stamens about as long as petals: fr. smooth. Brit. Col. to Ore., Mont., Idaho. Has been confused with *R. cognatum*, *R. divaricatum*, and *R. inerme*, which see.—*R. japonicum*, Maxim. Allied to *R. bracteosum*. Shrub, to 6 ft.: branchlets hairy: lvs. cordate, 5-lobed, pubescent and glandular beneath, to 6 in. broad: fls. greenish or brownish, tomentose and glandular, in upright racemes to 8 in. long; bracts linear: fr. black, smooth. Japan.—*R. latifolium*, Janca. Allied to *R. petraeum*. Unarmed shrub, to 6 ft.: lvs. 3-5-lobed, with acute lobes, glabrous or glandular-hairy, to 7 in. broad: fls. in racemes to $3\frac{1}{2}$ in. long, blood-red, campanulate: fr. red, rather large. Japan, Manchuria.—*R. laurifolium*, Janca. Evergreen shrub, to 6 ft.: lvs. coriaceous, ovate to ovate-oblong, crenate-serrate, glabrous, 2-4 in. long: fls. dioecious, greenish, flat; stamens and petals much shorter than sepals; staminate racemes pendulous, 1-1 $\frac{1}{2}$ in. long; pistillate upright, $\frac{1}{2}$ in. long: fr. ellipsoid, $\frac{3}{4}$ in. long, pubescent, reddish. W. China. B.M. 8543. G.C. III. 55:239. Gn. 76, p. 143; 79, pp. 170, 171. J.H.S. 38, p. 54, fig. 36. Not hardy North.—*R. laxiflorum*, Pursh. Allied to *R. glandulosum*. Unarmed procumbent shrub: lvs. deeply 5-lobed, slightly pubescent beneath, 2-4 in. broad: racemes upright-spreading; sepals longer, pubescent, but not glandular: fr. dark purple, bloomy, glandular. Alaska to N. Calif. Var. *coloradense*, Janca.—*R. coloradense*.—*R. luteum*, Cov. & Rose.—*R. montigenum*.—*R. leptanthum*, Gray. Spiny slender shrub, to 4 ft.: branchlets slightly pubescent: lvs. usually truncate, deeply 3-6-lobed, glabrous or pubescent, $\frac{1}{4}$ - $\frac{3}{4}$ in. broad: fls. 1-3, white, tinged with pink; calyx-tube cylindric; sepals reflexed: fr. black, lustrous. Colo., Utah, New Mex. and Ariz. Gt. 53, p. 409. Graceful small shrub. Var. *quercetorum*, Janca.—*R. quercetorum*.—*R. longiracemosum*, Franch. Allied to *R. petraeum*. Unarmed shrub, to 10 ft.: lvs. cordate, 3-5-lobed, with acute or acuminate lobes, glabrous, to 6 in. broad: racemes pendulous, to 12 in. long, thinly set with greenish or pinkish fls.; calyx-tube broadly campanulate; sepals upright; bracts oval, half as long as the slender pedicels, persistent: fr. black, edible. W. China. Var. *Wilsonii*, Janca. Young branchlets red: racemes shorter; fls. salmon-red. Cent. China.—*R.*

luridum, Hook. f. & Thom. Allied to *R. alpinum*. Unarmed shrub; branchlets glabrous, red; lvs. 3-5-lobed, with obtusish lobes, glabrous or nearly so, glandular, to 2 in. broad; fls. dioecious, dark purple, in upright racemes, the staminate 1-2 in. long, the pistillate shorter; fr. black, glabrous. Himalayas, W. China.—*R. malacrum*, Smith (*R. sanguineum malvacum*, Loud.). Allied to *R. sanguineum*. Unarmed shrub; lvs. rough above, grayish tomentose and glandular beneath; fls. pink or purple, smaller, white-pubescent and glandular; tube longer than the sepals; fr. viscid-pubescent. Calif.—*R. Marshallii*, Greene. Allied to *R. Lobbii*. Spiny shrub with puberulent branchlets; lvs. deeply cordate, 3-5-lobed, glabrous, 1-1½ in. wide; fls. solitary, large, purplish; sepals ½-¾ in. long; stamens slightly longer; petals salmon-pink; fr. purplish black, prickly. Calif.—*R. Marimonitense*, Batal. Allied to *R. alpinum*. Shrub, to 10 ft.; branchlets pubescent; lvs. slightly 3-5-lobed, middle lobe much longer, or undivided and ovate, pubescent on both sides, 1½-4 in. long; fls. dioecious, in upright racemes 1-2 in. long; fr. glandular-hairy, red. N. W. China.—*R. Menziesii*, Pursh (*R. subvestitum*, Hook. & Arn.). Allied to *R. Lobbii*. Spiny shrub, to 6 ft.; branchlets pubescent and bristly; lvs. deeply 3-5-lobed, pubescent and glandular beneath, 1-2 in. broad; fls. purple, with white petals; stamens as long as the sepals, with ovate-lanceolate anthers; fr. glandular-bristly. Ore. to Calif. G.C. III. 45:242. R.H. 1908, p. 31.—*R. Meyeri*, Maxim. Allied to *R. petraeum*. Unarmed shrub, to 10 ft.; lvs. usually 5-lobed, with acutish lobes, glabrous or glandular-hairy above, to 3½ in. broad; racemes horizontal, lax, to 2 in. long; fls. purplish, nearly sessile, small, with upright sepals; fr. black, lustrous. Cent. Asia, W. China. Var. *turkestanicum*, Janz. Lvs. obtusely lobed; racemes longer; fls. blood-red. Turkestan.—*R. mogollonicum*, Greene=*R. Wolfii*.—*R. molle*, Howell, not Poepp.=*R. montigenum*.—*R. montigenum*, McClatchie (*R. lacustre* var. *molle*, Gray. *R. lentum*, Cov. & Rose). Allied to *R. lacustre*. Sta. bristly; lvs. pubescent and glandular; racemes few-fl.; fr. red, glandular-bristly, edible. Wash. to Mont., Idaho to New Mex.—*R. moupinense*, Franch. Allied to *R. petraeum*. Shrub, to 15 ft.; lvs. 3-5-lobed, with acute or acuminate lobes, sparingly glandular, otherwise glabrous, to 6 in. broad; racemes pendulous, loose, 1½-5 in. long; fls. greenish tinged with red, or red; sepals upright; fr. black, lustrous. W. China.—*R. nevadense*, Kellogg (*R. sanguineum* var. *variegatum*, Wats. *R. variegatum*, A. Nelson). Allied to *R. sanguineum*. Unarmed shrub; lvs. thin, 3-5-lobed, sparingly pubescent or glabrous; fls. smaller, rose-colored; sepals about twice as long as the tube; petals white; fr. blue, glaucous. Ore., Calif., Nev.—*R. occidentale*, Hook. & Arn. (*R. californicum*, Hook. & Arn.). Allied to *R. Roezlii*. Spiny shrub, to 6 ft.; lvs. usually 5-lobed, glabrous or nearly so, about 1 in. broad; fls. green or purplish; calyx-tube about as long as broad; sepals glabrous, except a tuft of hairs at the apex; stamens as long as sepals; fr. prickly. Cent. Calif.—*R. orientale*, Desf. Allied to *R. alpinum*. Unarmed shrub, to 6 ft.; young growth glandular-viscid; lvs. lustrous above, pubescent beneath; fls. dioecious, greenish, tinged with red, glandular, in upright racemes 1-2 in. long; fr. red, pubescent. S. E. Eu. W. Asia. B.M. 1583 (as *R. resinosum*).—*R. palouense*, Elmer=*R. cognatum*.—*R. pulchellum*, Turcz. Allied to *R. diacantha*. Spiny shrub, to 6 ft., glabrous; lvs. truncate to subcordate, deeply 3-lobed, to 2 in. broad; fls. purplish, in upright racemes, the staminate to 2½ in. long, the pistillate shorter; fr. large, red, glabrous. N. China, Transbaikal.—*R. quercetorum*, Greene. Spiny slender shrub, sometimes bristly; lvs. 3-5-cleft, finely pubescent or usually glabrous, ½-¾ in. long; fls. 2-3, pale yellowish with short-cylindric tube; petals shorter than the sepals, a little longer than the stamens; fr. smooth, purple. Cent. Calif. to Low. Calif.—*R. resinosum*, Pursh=*R. orientale*.—*R. robustum*, Janz. (*R. niveum* × *R. hirtellum*). Intermediate between the parents. Spiny vigorous shrub, only the stronger shoots bristly; fls. white or pinkish, but sepals broader and shorter and filaments shorter and less pubescent than in *R. niveum*; fr. black. Origin unknown. *R. Saundersii*, Janz. (*R. hudsonianum* × *R. nigrum*). Intermediate between the parents; fls. pink, fading to whitish; fr. black. Originated in Ottawa.—*R. stenocarpum*, Maxim. Allied to *R. alpestre*. Spiny shrub, often bristly; lvs. cordate, 3-5-lobed, glabrous or pubescent, about 1½ in. across; fls. 1-3, short-peduncled, reddish or pale; calyx-tube campanulate, shorter than the reflexed sepals; stamens scarcely longer than petals; fr. oblong, ¾-1 in. long, glabrous or hispid. N. W. China.—*R. subvestitum*, Hook. & Arn.=*R. Menziesii*.—*R. succubum*, Zabel (*R. niveum* × *R. divaricatum*). Intermediate between the parents. Lvs. similar to those of *R. niveum*; fls. pink or pinkish; stamens 1½ times as long as sepals; fr. black, slightly pruinose. Originated at Gotha, Germany.—*R. thouxii*, Janz. Allied to *R. alpinum*. Unarmed slender shrub; lvs. 3-5-lobed, lobes acute, incisedly dentate, the middle one longer, glandular, to 1½ in. long; fls. reddish brown or greenish, dioecious, in upright racemes; fr. red. Cent. and W. China, Himalayas.—*R. trilobum*, Mey.=*R. Gayanum*.—*R. ureodatum*, Fausch (*R. multiflorum* × *R. petraeum*). Intermediate between the parents. Fls. reddish; fr. red. Origin unknown.—*R. vitifolium*, Janz. *R. Cynobati* × *R. Grossularia*. Intermediate between the parents. Lvs. similar to *R. Grossularia*; fls. slightly pubescent; ovary glabrous; fr. purplish, sometimes with a few spines. A more detailed description will be found under the name of "Mountain" in G.F. 9:456. It originated with the Shakers of Lebanon, N. Y.—*R. variegatum*, A. Nelson=*R. nevadense*.—*R. ribaripolium*, Gray. Evergreen, unarmed, aromatically scented shrub, to 8 ft.; branchlets glandular; lvs. ovate or oval, obtuse, coarsely toothed, glossy above, resinous-dotted beneath, ¾-1¾ in. long; fls. dark pink, in upright racemes; fr. ovoid, red. Low. Calif., Santa Catalina Is. B.M. 8094.—*R. villosum*, Gay, not Nutt.—*R. Gayanum*.—*R. Vilmorinii*, Janz. Allied to *R. alpinum*. Unarmed shrub, to 6 ft.; lvs. 3-5-lobed with obtuse or acutish lobes, glandular above, about 1 in. broad; fls. dioecious in short upright racemes, greenish or tinged reddish brown; fr. small, black, glabrous or glandular. W. China.—*R. Warsce-*

witzi, Janz. Allied to *R. rubrum*. Unarmed shrub, to 6 ft.; lvs. slightly 3-5-lobed, slightly pubescent below, to 4 in. broad; fls. larger, pinkish, in pendent racemes 2 in. long; fr. larger, purplish black, very acid. E. Siberia.—*R. Watsonianum*, Koehne (*R. ambiguum*, Wats., not Maxim.). Allied to *R. pinetorum*. Spiny shrub, upright or ascending; branches glandular, not bristly; lvs. deeply 3-5-lobed, sparingly pubescent on the veins, 1-2 in. broad; fls. pinkish, pubescent; petals white, one-fourth shorter than sepals; stamens as long as petals; fr. greenish, prickly. Wash.—*R. Wolfii*, Rothr. (*R. mogollonicum*, Greene). Allied to *R. sanguineum*. Unarmed shrub, to 10 ft.; lvs. 3-5-lobed, pubescent on the veins and glandular beneath, 2-3½ in. broad; fls. greenish white, in upright long-stalked racemes, 1-1½ in. long; fr. black, bloomy, glandular-bristly. Colo., Utah, New Mex., Ariz. B.M. 8120.—*R. wollense*, Bean=*R. Culverwellii* var. *wollense*. ALFRED REHDER.

RICCIA (P. F. Ricci, Italian nobleman, patron of the botanist Micheli). *Ricciaceae*. *Riccia fluitans*, Linn., is one of the few flowerless or cryptogamous plants in cultivation aside from the ferns, mushrooms and selaginellas. It has been listed by one specialist in aquatics presumably for the benefit of students of botany. It is not generally advertised among aquarium plants. The form used in aquaria is the floating sterile state; the fruiting state (*R. canaliculata*, Hoffm.) grows on the ground in muddy places. In this family of plants the plant-body is a thallus (i. e., a green, flattish body not differentiated into root, stem and leaves). The thallus of *Riccia* spreads out in green patches which are at first radiately divided, and the center of the plant often decays quickly. *R. fluitans* is distinguished from other species by the linear dichotomous thallus, with the capsule protuberant from the lower surface.

RICCIOCARPUS (*Riccia-fruited*). *Ricciaceae*. The single formerly recognized species of this genus, *R. natans*, Corda, is offered abroad as an aquarium plant. It is a small floating plant, consisting of a single spatulate frond about ½ in. or less long, more or less cleft or cordate at the larger end or dichotomously branched, from the under side of which many root-like bodies are emitted. It is widely distributed over the earth. From *Riccia*, the plant is distinguished by technical characters of archegonia and antheridia, and it has been united with that genus by some authors. A second species has recently been added to the genus, *R. velutinus*, Steph., from W. Amer.; it appears not to have been listed for cultivators.

RICE: *Oryza*. **R. Flower:** *Pimelia*. **R., Mountain:** *Oryzopsis*. **R. Paper:** The Chinese rice paper is made from *Fatsia japonica*, which see.

RICHÁRDIA: *Zantedeschia*.

RICINOCÁRPOS (from *Ricinus* and Greek for fruit). *Euphorbiaceae*. Tropical shrubs sometimes cult. for ornament; glabrous to stellate-tomentose, often heath-like; lvs. alternate, simple, entire, linear to lanceolate; stipules none; fls. small, solitary or clustered, rarely apetalous; calyx imbricate; stamens numerous; ovules 1 in each cell. Fifteen species of Austral. *R. pinifolius*, Desf., NATIVE JASMINE, glabrous, lvs. linear; and *R. speciosus*, Muell. Arg., tomentose, lvs. oblong, have occasionally been cult. J. B. S. NORTON.

RICINODÉNDRON (from *Ricinus* and Greek for tree). *Euphorbiaceae*. Tropical trees with economic uses, but rarely cult.; juice milky; lvs. alternate, long-petioled, palmately 3-9-foliate, stipulate; fls. small, in loose panicles; calyx imbricate; petals connate or free; stamens numerous, filaments free; ovules 1 in each cell. Three or four species in Afr. *R. Heudelotii*, Pierre, is a prominent plant in W. Afr. J. B. S. NORTON.

RÍCINUS (the name in classical languages applied to the castor bean seed and to a similar tick). *Euphorbiaceae*. Plants cultivated for the oil of the seed and as tall annuals for the bold and ornamental foliage; useful for screens.

Herbaceous, or becoming small trees in the tropics, glabrous, or rarely subspinose, branching repeatedly from below the fl.-clusters: lvs. large, alternate, peltate, palmately 5-12-lobed, the lobes dentate or serrate; petiole with conspicuous glands: fls. monœcious, in terminal or apparently lateral racemes or subpaniculate, without petals or disk;



3409. Fruit of castor bean, showing the capsules inside. (X1)

calyx 3-5-parted, valvate; staminate fls. short-pedicelled, in the upper part of the raceme; stamens many, filaments much branched, no rudimentary pistil; pistillate fls. below, longer-pedicelled; styles 3, plumose: caps. generally covered with soft spinose processes, 3-celled, 1 ovule in each cell, explosively separating into 2-valved cocci when ripe; seeds ovoid, with a large caruncle; seed-coat crustaceous, variously marked and colored; endosperm fleshy and oily; cotyledons broad, cordate or ovate.—Hundreds of forms are known, many so well marked as to deserve specific rank, were they not so thoroughly connected by intermediate forms and hybridizing so freely when brought together. Most botanists follow Mueller (De Candolle's Prodr., vol. 15, pt. 2:1061, 1866) in referring them all to the one species. Probably a native of Afr., but now cult. and wild in most tropical and temperate lands.

Castor beans have been cultivated from the earliest times for the oil of the seeds. The Hebrew name indicates that perhaps this is the plant referred to in the Book of Jonah as a gourd. The oil (castor-oil, *Oleum Ricini*) is used in medicine and in the arts and in some places in the preparation of food. The seed contains a poisonous principle, ricinin. For the cultivation of castor beans as a field crop, see "Cyclopedia of American Agriculture," 2:229. The chief castor-oil-producing region is in India, but some is grown in the United States, especially in Oklahoma.



3410. *Ricinus communis*.

Ricinus is one of the best plants for giving a tropical effect in beds and borders or planted singly. It thrives in rich well-drained sandy or clay loam, but is not suited for stiff clay or very sandy soil. For garden decoration the seeds may be planted in May where they are to grow, or sown indoors in small pots, two or



3411. Clump of *Ricinus communis*.

three seeds each, in early spring, and after germination thinned to one plant to a pot. As they grow they may be transferred to larger pots and finally planted out. The castor beans have practically no insect or fungous enemies of importance. They have been erroneously supposed to keep away moles and malaria.

communis, Linn. CASTOR BEAN. CASTOR-OIL PLANT. PALMA CHRISTI. Figs. 3409-3411. Three to 15 ft. high when grown as an annual, 30-40 ft. in the tropics. The various varieties are distinguished by the size, color, and outline of the plant and lvs., the glands of the petiole, the number and size of the processes on the caps., the shape of the cotyledons, and especially the size, form, color, and markings of the seed, which show variations sufficient to distinguish individual plants, and even separate branches of the same plant. So far as the forms commonly in cult. are concerned, the species may be subdivided as follows:

A. Markings of seed-coat marbled, distinct from the ground-color; seed less than twice as broad as thick; cotyledons elliptical or oblong, nearly truncate at base, petiole-glands various.

B. Seeds small to medium, brown-marked; petiole-glands flat, not projecting. This includes most of the oil-producing varieties and the typical *R. communis* (illustrations, variety not designated: B.M. 2209. A.G. 17:363. F.W. 1868:98. Gn. 1, p. 541; 9, p. 460. Gt. 24, p. 281; 31, p. 20. Mn. 7, p. 223. R.H. 1861, pp. 9, 10. V. 2:224); also the following varieties: *giganteus* (lividus, Willd., *pruinosus*, ?), glaucous foliage (V. 16:148); *arbores*; *major*; *minor*; *viridis*, sts. and lvs. green; *inermis*, fr. smooth; *purpurascens*; *africanus*; *elegantissimus*; *speciosus*.

BB. Seeds medium to large, reddish to reddish-brown: glands of petiole large, projecting: plant usually red: st. often more hollow, short-lived and early-fruited. The typical form is var. *sanguineus* (Obermanni, *lividus*, Jacq.?) (Gn. 5, p. 349. R.H. 1858, pp. 602, 603); *macrocarpus* (V. 16:148); *purpureus* (tricolor); *atropurpureus*; *sanguinolentus*; *macrophyllus*?; *macrophyllus purpureus*; *pulcherrimus*.

BBB. Seeds as in BB, but dark brown to black: otherwise as in B. *Bourboniensis*, and its vars. *nanus* and *arbores* (V. 16:148).

AA. Markings of seed-coat rather straight, slightly raised above the ground-color and distinct from it; seeds

medium size, more than twice as broad as thick; cotyledons ovate, rounded at the base, glands small, flat; foliage red to almost black. Contains var. *Gibsonii*, dwarf, dark red with metallic luster; *Gibsonii coccinea*; *Gibsonii mirabilis*, bright carmine fr.; *camboensis*, very dark foliage; *hybridus panormitanus*, large, dark and glaucous, a cross with *zanzibarensis* and *philippinensis*.

AAA. Markings of seed-coat of fine bright red mottling, diffusing into the ground-color (gray or brown in some of the hybrids); seeds large, flat; cotyledons cordate; glands many, large, projecting at the apex and decurrent; plants large, generally without much red color, if any. Contains var. *zanzibarensis* (A.G. 16, p. 383. G.C. III. 14:783. Gn. 44, p. 563. Gt. 43, p. 69. I.H. 41:100) and its varieties, which seem to be crosses with some of the previous groups. (Gt. 44, p. 77.)

Other names in the trade, but not classified above, are: *cæruleus*, *Bismarckiana*, and *insignis*.

J. B. S. NORTON.

RIGIDÉLLA (Latin, somewhat rigid; referring to the pedicels, which after the petals fall become erect and stiff). *Iridaceæ*. Half-hardy bulbous plants allied to *Tigridia* and useful for planting in the garden.

Leaves broad, plicate, with channeled petiole; fls. fugitive, bright red, pedicelled; perianth-tube none; segms. very unequal, outer oblong, connivent in a cup in the lower third, then spreading or reflexed; inner very small, erect, ovate, with a narrow claw.—About 3 species, Mex. Distinguished from *Tigridia* by the very small inconspicuous ovate and erect inner perianth-segms., those of *Tigridia* being larger, fiddle-shaped and spreading.

flammea, Lindl. St. 3-5 ft. high: lvs. broadly equitant, plicate and sheathing the st. below: fls. in terminal fascicles, between the 2-valved spathe; peduncles recurved but becoming erect in fr.; perianth 3-foliate, the limb concave and revolute, bright scarlet striped black at the throat, spirally twisted after anthesis: caps. papery, 3-valved at the apex. Mex. B.R. 26:16. H.U. 2, p. 44.

immaculata, Herb. St. 2-3 ft. high, forked: lower lvs. narrowly lanceolate, acute, about as tall as the scape: fls. bright crimson, not marked with black; perianth-segms. acute, undulate, recurved. Mex. B.R. 27:68. F.S. 5:502; 21:2215 (fls. brick-red).

F. TRACY HUBBARD.†

RINDÈRA (named after Dr. A. Rinder, the discoverer of the first plants of this genus). *Boraginaceæ*. Perennial herbs, erect, canescent-pubescent, scabrous or glabrous, base often caespitose: sts. simple or sparingly branched: lvs. alternate, narrow: cymes terminal, corymbose or paniculate-racemose, without bracts; fls. pedicelled; calyx 5-parted, lobes narrow; corolla tubular-funnel-shaped; lobes 5, imbricate, broad or oblong, erect or somewhat spreading; stamens 5; ovary 4 distinct lobes: nutlets 4. About 10-15 species, S. Eu., W. and Cent. Asia. *R. umbellata*, Bunge. St. erect, 1-2 ft. high: basal lvs. tufted, evergreen, oblong to ovate-lanceolate, long-petioled; cauline lvs. lanceolate with a winged petiole or sessile, entire, gray-pubescent: fls. reddish yellow or dark brown; calyx densely woolly; corolla-lobes erect, oblong: nutlets ovate-orbicular, broadly winged. Hungary and Servia. G.C. III. 42:226.

RITÀIA (named after Mr. Rita of the Khasia Commission). *Orchidaceæ*. Epiphytic orchid, rare in cult.: st. much and subdichotomously branched, densely clothed with scarious sheaths: branches short and bearing a terminal sheathed, 1-2-fld. peduncle: lf. fleshy, lanceolate, jointed to the axis at the end of a branch: fls. small, puberulous; lateral sepals broad-based, adnate to the foot of the column; lip adnate by its margins to the column. One species, Himalaya. Now referred to

Ceratostylis. *C. himalaica*, Hook. f. (*Ritàia himalaica*, King & Pantl). Sts. pendulous with a solitary lf. and a single terminal peduncle: lf. fleshy, linear-oblong, apex obliquely notched: fls. 1, occasionally 2, pale yellow, pubescent outside; dorsal sepal ovate-lanceolate, lateral sepals broader, abruptly acuminate; petals linear, about as long as the sepals; lip fleshy, not lobed.

F. TRACY HUBBARD.

RIVINA (named after A. Q. Rivinus, professor of botany, at Leipzig, 1691-1725). *Phytolaccaceæ*. Erect



3412. *Rivina humilis*. (× 1/4)

herbs, shrubby at base, suitable for the warm-house and also useful outdoors as a summer annual.

Leaves alternate, slender-petioled, ovate, ovate-lanceolate or cordate-ovate; stipules minute and caducous: infl. racemose, axillary or rarely terminal; fls. small, perfect; perianth 4-

parted; stamens 4: berry red, pea-like.—Species 3 (Walter, Engler's Pflanzenreich, hft. 39), native of Trop. and Subtrop. Amer., but intro. into Asia and Afr.

humilis, Linn. (*R. laevis*, Linn.). **ROUGE PLANT**. Fig. 3412. St. with spreading branches, 1/2-2 ft. high: lvs. 1-3 in. long: racemes slender, pendulous, many-fld., as long as the lvs.; fls. white, 1-1 1/2 lines long; calyx pale rose: fr. 1-1 1/2 lines long. S. Fla. B.M. 1781. V. 5:75. S.H. 2:111. Gn. 22, p. 68.—Variable.

F. TRACY HUBBARD.

ROBINIA (after Jean and Vespasien Robin, herb-alists to the king of France in the sixteenth and seventeenth centuries). *Leguminosæ*. **LOCUST**. Ornamental woody plants grown chiefly for their handsome white, pink, or purple flowers and the graceful foliage.

Deciduous trees or shrubs: branches without terminal bud, often with stipular spines: lvs. alternate, stipulate, odd-pinnate, with stalked entire stipellate lfts.: fls. slender-pedicelled, in axillary racemes; calyx campanulate, 5-toothed, slightly 2-lipped; corolla papilionaceous, with short-unguiculate petals, standard large, rounded, turned back, scarcely longer than wings and keel; 9 stamens connate, 1 free or partly free: pod oblong to linear, flat, several-seeded, dehiscent.—About 15 species in N. and Cent. Amer.

The locusts are all handsome shrubs and trees with bright green and graceful pinnate foliage and showy white, pink, or purple papilionaceous flowers in usually pendulous or nodding racemes followed by pods attractive in some species by the dense covering of purple hairs. *R. Pseudacacia* and *R. viscosa* are hardy as far north as Ontario, and most other cultivated species as far north as Massachusetts. They are not particular as to the soil and they do well even in poor sandy soil and dry locations. They stand transplanting well and grow rapidly while young. Some species, particularly *R. hispida*, spread by suckers and may for this reason become a nuisance in lawns and mixed groups. *R. Pseudacacia*, on account of its heat- and drought-resisting qualities, together with its ornamental merits, has become a favorite street tree for cities, particularly in Europe; in this country it is now not so much planted, as it is liable to the attacks of the borer and therefore short-lived; it stands severe pruning well. Propagation is by seeds sown in spring and germinating readily; they

may also be increased by suckers and some, particularly *R. hispida*, grow readily from root-cuttings. Varieties are usually grafted, either on young seedling stock in the house or outdoors in spring or on pieces of root in the greenhouse; some dwarf forms, as *R. Pseudacacia* var. *Rehderi* are propagated by division, and other varieties, particularly var. *Bessoniana*, by cuttings of mature wood in fall; some varieties, as var. *Decaisneana* and var. *monophylla*, may be raised from seed, as a large percentage comes true.

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A. Fls. white (light pink in one variety): branchlets glabrous or slightly pubescent: pod smooth.

1. *Pseudacacia*, Linn. FALSE ACACIA. BLACK LOCUST. YELLOW LOCUST. Fig. 3413. Tree, to 80 ft., with deeply furrowed dark brown bark and prickly branches: lfts. 7-19, oval or elliptic, rounded or truncate and mucronate at the apex, glabrous or slightly pubescent while young, 1-2 in. long: fls. white, very fragrant, about $\frac{3}{4}$ in. long, in pendulous puberulous racemes 4-5 in. long: pod linear-oblong, reddish brown, 3-4 in. long. May, June; fr. in Aug. and Sept., remaining on the branches during the winter. Pa. to Ga., west to Iowa, Mo., and Okla., often naturalized elsewhere; probably the only American tree which has become extensively naturalized in Eu. S.S. 3:112, 113. F.E. 32:393. Gn. 61, p. 61. G.M. 45:513. H.W. 3:58, p. 104.—Many varieties are in cult., of which perhaps the following are the best known. Var. *umbraculifera*, DC. (var. *inermis*, Kirchn., not DC.). Forming a dense subglobose head, with unarmed branches: rarely flowering. Much used in Eu., when grafted high, in formal plantations and as a small street tree. M.D.G. 1903:630. Var. *Bessoniana*, Nichols., with slenderer branches forming a less dense head, and var. *Rehderi*, Kirchn., a low subglobose form, usually grown on its own roots (G.W. 2, p. 217), are forms of var. *umbraculifera*. Var. *stricta*, Loud., is a broadly pyramidal form. Var. *pyramidalis*, Pépin (var. *fastigiata*, Nichols.), is a narrow pyramidal or columnar form with unarmed branches. Gt. 6:190. I.H. 6, p. 20. B.H. 14, p. 27. F. 1874, p. 242. G.C. III. 41:151. Var. *pendula*, Loud., with somewhat pendulous branches. Var. *tortuosa*, DC. A slow-growing form with short twisted branches sometimes pendulous at the tips. G.W. 2, p. 218. Var. *Ulriciana*, Reuter. With spreading slightly pendulous branches and large drooping lvs. Var. *inermis*, DC. Branches unarmed: lvs. dark green: habit like the type. Var. *monophylla*, Carr. Lvs. simple or partly with 3-7 large lfts. R.H. 1860, pp. 630, 631. Var. *bullata*, Koch. Lfts. crowded, more or less bullate. Var. *crispa*, DC. Lfts. undulate or crisped. Var. *amorphifolia*, Loud. (var. *mimosafolia*, Hort.), with narrow, oblong lfts. Var. *dissecta*, Nichols. Lfts. linear. R.H. 1875, p. 379. Var. *atrea*, Kirchn. Foliage yellow. Var. *purpurea*, Dipp. Young foliage purple. Var. *sempervirens*, Carr. Flowering during the whole summer. R.H. 1875:191. Var. *Decaisneana*, Carr. Fls. light rose-colored. R.H. 1863:151. F.S. 19:2027. I.H. 12:427. Gn. 9:36; 34, p. 174. G.Z. 9:160. G.M. 56:971.—This is the largest species of the genus and its hard and strong, close-grained timber is much esteemed for its strength and its durability in contact with the soil.

AA. Fls. pink or purple.

B. Plant glabrous or merely pubescent or tomentose: lfts. usually less than 15.

c. Pod smooth.

2. *Boynntonii*, Ashe. Shrub, to 10 ft., unarmed: branchlets glabrous or minutely pubescent at first: lfts. 7-13, elliptic to oblong, obtuse, soon glabrous, $\frac{3}{4}$ -1 in. long: racemes 8-12-fld., on spreading or ascending peduncles; corolla rose-purple or pink with white, $\frac{3}{4}$ in. long: pod glabrous. May, June. N. C. and Tenn. to Ga. and Ala.

cc. Pod hispid or glandular hairy.

3. *Kelseyi*, Bean. Shrub, to 10 ft.: branches with slender prickles; branchlets glabrous: lfts. 9-11, oblong-lanceolate, acute, rounded at the base, glabrous, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: racemes 5-8-fld.; rachis and pedicels sparingly glandular-hairy; calyx finely pubescent, with or without glandular hairs; corolla rose-colored, 1 in. long: pod oblong, densely covered with purple glandular hairs, 1 $\frac{1}{2}$ -2 in. long. May, June. N. C. B.M. 8213. G.C. III. 44:427; 47:391; 58:72. J.H. 8. 36, p. 133, fig. 134. G. 33:461, 463. M.D. 1910, p. 101. Addisonia 1:3.—Very handsome and graceful; the purple frs. are also attractive.



4. *Elliottii*, Ashe (*R. hispida* var. *rosea*, Elliott). Shrub, to 5 ft.: branches with short spines; young branchlets grayish or whitish tomentose: lfts. 11-15, elliptic, grayish pubescent beneath, $\frac{3}{4}$ -1 in. long: racemes 5-10-fld.; peduncles, pedicels, and calyx grayish pubescent; corolla rose-purple or purple and white: pod linear, hispid. May, June. N. C. to Ga.—A very handsome species easily distinguished by the dense grayish pubescence without glands or bristles.

BB. Plant more or less bristly or glandular-pubescent or viscid: pod hispid.

c. Peduncles and branchlets hispid or the latter sometimes glabrous: lfts. usually less than 15.

5. *hispida*, Linn. (*R. rosea*, Marsh.). ROSE ACACIA. Fig. 3414. Shrub, 1-3 ft., rarely higher: st., branchlets, and peduncles and often the petioles hispid: lfts. 7-13, suborbicular to oval, obtuse and mucronate, glabrous or nearly so, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: fls. rose-colored or pale purple, 1 in. long, in short, 3-5-fld. racemes: pod rarely developed, densely hispid, few-seeded. F.S.R. 2, p. 57. J.H. III. 53:183. G. 4:499. Var. *macrophylla*, DC. (var. *inermis*, Kirchn.). Branchlets and petioles nearly destitute of bristles: lfts. and fls. often somewhat larger. Gn. 77, p. 268. G.M. 45:512.—This species spreads much by suckers, particularly in sandy soil; sometimes grafted high to form a small standard and as such displaying its large fls. to greater advantage.

6. *nana*, Spach (*R. hispida* var. *nana*, Elliott). Shrub, about 1 ft. high, in cult. sometimes higher: sts.

hispid, branchlets, petioles, and peduncles only pubescent or more or less hispid; lfts. 9-15, elliptic or ovate, acute, narrowed or rounded at the base, appressed-pubescent beneath, at least while young, $\frac{1}{2}$ -1 in. long; racemes 3-6-fl'd.; corolla $\frac{3}{4}$ in. long, purple with white; pod oblong, hispid. May, June. N. and S. C.—This species usually fruits profusely, while the preceding species never or very rarely fruits.

cc. Peduncles and branchlets glandular-hairy or viscid; lfts. usually more than 15.

d. Branchlets and peduncles glandular-hairy.

e. Rachis of lf. pubescent, glandless or nearly so.

7. *neo-mexicana*, Gray. Shrub or small tree, to 25 ft.: branches spiny; branchlets pubescent and glandular; petioles villous; lfts. 15-21, elliptic-oblong, rounded and mucronate, silky pubescent beneath at least while young, 1-1 $\frac{1}{2}$ in. long; racemes many-fl'd., dense, more or less upright; peduncle and pedicels glandular-hairy; corolla pale rose-colored or sometimes nearly white,



3414. Rose acacia.
—*Robinia hispida*.
($\times \frac{1}{2}$)

nearly 1 in. long; pod glandular-hispid, 3-4 in. long. June to Aug. Colo. to New Mex., Ariz., and Utah. B.M. 7726. S.S. 3:114. F.S.R. 2:56. Gt. 41:1385. R.H. 1895.—Valuable for its late flowering.

8. *Hölldtii*, Beissn. (*R. neo-mexicana* \times *R. Pseud-acacia*). Tree, intermediate between the parents: lfts. larger than those of *R. neo-mexicana*, 1 $\frac{1}{2}$ -2 in. long, darker green and firmer than those of *R. Pseud-acacia*; racemes looser than those of the first parent; corolla light pink to rose-colored; pod with scattered stalked glands. Originated in the nursery of F. von Holdt, Alcott, Colo. Var. *britzensis*, Spaeth. A form with nearly whitish fls., originated in Spaeth's nursery near Berlin, Germany. Also *R. coloradensis*, Dode, probably belongs here.

EE. Rachis of lf. densely covered with stalked glands.

9. *Härtwigii*, Koehne. Shrub, to 12 ft.: branchlets, petioles, lf.-rachis, and peduncle puberulous and densely covered with stipitate glands; lfts. 13-23, elliptic to lanceolate, mucronate, grayish pubescent beneath, 1-1 $\frac{3}{4}$ in. long; racemes dense; calyx pubescent and glandular-hairy; corolla rosy purple, $\frac{3}{4}$ in. long; pod oblong, densely glandular-hairy, about 2 in. long. June, July. N. C. to Ala.

DD. Branchlets and peduncles viscid.

10. *viscosa*, Vent. (*R. glutinosa*, Sims). Tree, to 40 ft.: branches without or with small and slender spines; the dark reddish brown branchlets and usually the petioles and peduncles densely glandular-viscid; lfts. 13-25, ovate to oblong, obtuse or acute, broadly cuneate at the base, pubescent beneath or sometimes glabrous, 1 $\frac{1}{2}$ -2 in. long; racemes 6-15-fl'd., dense, rather upright; corolla $\frac{3}{4}$ in. long, pink; standard with a yellow blotch; pod linear-oblong, glandular-hispid,

2-3 $\frac{1}{2}$ in. long. May, June. N. and S. C. to Ala.; naturalized elsewhere. S.S. 3:115. B.M. 560.

11. *dùbia*, Foucauld (*R. ambigua*, Poir. *R. intermedia*, Soulange-Bodin. *R. Pseudacacia* \times *R. viscosa*). Tree, intermediate between the parents, but more similar to *R. Pseudacacia*, from which it differs in the slightly viscid, less prickly branches, in the 15-21 lfts., and in the light pink fls. Of garden origin. Var. *bélla-rôsea*, Rehd. (*R. bélla-rôsea*, Nichols. *R. viscosa* var. *bélla-rôsea*, Voss. *R. Pseudacacia* var. *bélla-rôsea*, Cowell). Branchlets more viscid; fls. larger and deeper rose-colored. Garden origin.

R. Rûsbyi, Wooton & Standley. Nearly glabrous prickly shrub with oval or broadly oblong lfts. pubescent beneath, many-fl'd. racemes with the pedicels glandular-pubescent, and with smooth pods, from New Mex.; this and the 6 or 7 Mexican species are not in cult.

ALFRED REHDER.

ROBÝNSIA (derivation not known). *Leguminosæ*. Twining shrubs, with trifoliate lvs. and elongated axillary racemes: fls. somewhat fasciated; calyx 2-lipped; corolla papilionaceous, standard somewhat rounded, sulcate at the base, wings oblong, obtuse, keel incurved, obtuse; stamens diadelphous; pod compressed, 2-valved, linear-elongate.—Two or 3 species, Mex. The genus is now usually included in *Pachyrhizus*. *R. geminiflora*, Hort., is apparently botanically unknown. H.U. 2, p. 231.

ROCAMBOLE (*Allium Scorodoprasum*, Linn.), is a humble member of the onion tribe, the underground bulbs of which are used abroad like garlic, known in America amongst the Canadian French and perhaps elsewhere. The plant is a hardy perennial, with a stem twisted spirally above and bears at the top an umbel of flowers, some or all of which are changed to bulblets. The presence of these bulblets distinguishes the plant from garlic. The species can be propagated by the bulblets, but quicker results are secured from the cloves of the underground bulbs. In mild climates, the bulbs should be planted in autumn or not later than February; in cold climates, plant in spring. In the autumn when the leaves decay, the bulbs are lifted, dried in the sun, and stored.

Rocambole is a native of Europe, the Caucasus region, and Syria. It has flat or keeled leaves, short spathe, bell-shaped six-parted perianth, and the three inner stamens broader than the others, three-cleft, and not longer than the perianth. Good seeds are rarely produced.

RÔCHEA (named after de la Roche, French botanist). Syn., *Kalosánthes*. *Crassulacæ*. Succulent shrubby plants suitable for the greenhouse.

Leaves opposite, connate at the base, oblong-ovate or lanceolate; fls. rather large, aggregated in corymbose-capitate cymes, white, yellow, rose, or red; calyx 5-parted or 5-cleft; corolla salver-shaped, the elongated claws of the petals connate with the calyx-tube, limb spreading; follicles many-seeded.—About 4 or 5 species, S. Afr.

Rocheas are amongst the showiest of our summer-flowering greenhouse plants, and are very easy to propagate. If plants are desired from a single root, cuttings about 4 inches long should be selected in March, and potted singly in sandy peat. The small pots should be placed near the glass, in a night temperature of 50°. Do not keep them too wet, as they are of a fleshy nature, and are liable to rot. In a few weeks, the plants will be rooted and the points may be cut out to encourage breaks. A few days after they are cut back, repot into a pot two sizes larger, using two parts fibry loam, one of sand, and one of broken charcoal, adding a sixth part of sheep-manure. After they are rooted, keep them near the glass, in a night temperature of not over 40°, when this is possible.



XCVII. A rock-garden.

XXXXX
XXXXX
XXXXX
XXXXX
XXXXX

When all danger of frost is past, set them outdoors on a bed of ashes in the full sun, making some provision to protect them from rainstorms, so as to prevent water lodging in the points of the shoots, which is liable to bring about conditions favorable to disease. Toward the end of September, have the plants housed in their winter quarters; all that is necessary during the winter is to keep them from freezing. In spring, the points of the shoots may be cut out again, to encourage more breaks and soon after they may receive another shift. Treat them as advised above, and when the pots are well filled with roots, they may be watered with manure-water as advised for ixoras. Rocheas may be flowered the second summer after the cuttings are struck, and after flowering the plants may be cut back to 6 inches above the pot. These cut-back plants may be shifted along, after they break, and be grown into large specimens. Fine plants of rochea may also be grown in the following manner: Take a 10- or 12-inch pot, and fill it with the compost advised above, the last 2 inches being pure sand. Insert the cuttings as thick as they can be pricked into the pot. The cuttings may be secured from a plant that has flowered. Breaks will start all over the stems of such plants, and in the fall after flowering they will be large enough to use for cuttings. In eighteen months this pot of cuttings will come in flower and will have more than doubled the number of shoots. Aphides are the only insect pest that molest the rocheas, and these may be destroyed by fumigating with tobacco in some of its forms. These plants require at all times abundance of fresh air, and if this is not given, they will be attacked by fungous disease. (George F. Stewart.)

A. *Clusters usually 2-fld.*

jasminea, DC. (*Crassula jasminea*, Ker-Gawl). St. subshrubby, 4-12 in. high, decumbent, branched, flowering part erect: lvs. fleshy, oblong-oval or spatulate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long; fls. white, tinted with crimson, sessile, not fragrant, $1\frac{1}{2}$ in. long. Cape B.M. 2178. L.B.C. 11:1040.—Hybrids with *R. coccinea* are figured in A.F. 5:433.

AA. *Clusters many-fld.*

coccinea, DC. (*Kalosanthes coccinea*, Haw. *Crassula coccinea*, Linn.). Plant robust, shrubby, 1-2 ft. high: lvs. very closely imbricated, ovate-oblong or ovate, $1-1\frac{1}{2} \times \frac{3}{4}-1$ in.: fls. bright scarlet, $1\frac{1}{2}-2$ in. long, fragrant, borne in summer. Cape. Gn. 46, p. 360. B.M. 495.—Showy; hybrids are in cult.

R. falcata, DC.—*Crassula falcata*.—*R. hybrida albiflora* is said to be a hybrid between *R. jasminea* and *R. odoratissima*.—*R. odoratissima*, D.C. Somewhat shrubby, 12-20 in.: lvs. connate, erect-spreading, linear-lanceolate or subulate: fls. 1 in. long, fragrant, pale yellow or cream-colored. Cape.

L. H. B.†

ROCK-GARDEN. An ornamental planting in very rocky places or in areas on which rocks have been placed for the particular purpose to make congenial conditions for certain classes of plants and also to lend interest and variety to a part of the grounds; a rockery. Figs. 3415-3419. See, also, *Alpine Plants*, Vol. I.

Nature in time will make a garden even on the broken surface of a rock, by clothing it with lichens, algæ, and mosses of many exquisite forms having much variety and often striking brilliancy in coloring. If there are soil-filled cracks and pockets, then ferns and flowering plants will find a place. At low elevations, however, these flowering rock-plants are comparatively few, for soil accumulates rapidly and strong-growing herbs, shrubs, and trees, aided by favorable climatic conditions, soon cover the rock surface or furnish so dense a shade that only mosses, lichens, and ferns will thrive.

The ideal rock- or alpine gardens are within that region on mountain summits between the limits of tree-growth and the edge of perpetual snow, and in the corresponding regions toward the poles, where the plants are protected from the rigors of a long winter by

blankets of snow and are quickened into a short period of rapid growth by a comparatively low summer temperature. Here, where there are deep cool moist rock-crevices and pockets filled with fragments of broken stone and porous decayed vegetable matter, are the favorable conditions wherein the real alpine plants can multiply their neat and dainty cushions, tufts, and rosettes of dense and matted foliage and their abundance of exquisitely formed and brilliantly colored flowers. A successfully grown collection of these plants in contrast with ordinary garden flowers would be like a collection of cut gems as compared with one of rough minerals and rocks, for they have an exquisiteness of finish and depth of coloring that gives them as unique a place in the vegetable kingdom as they have in the plan of nature. Surely there are men and women who, if they knew these plants well, would be fired with an ambition to excel in their cultivation; and in so doing they may enter a comparatively untrodden path if they will limit their work chiefly to the alps of this continent. They are represented in the New England mountain region by such species as *Arenaria grænlantica*, *Loiseleuria procumbens*, *Silene acaulis*, *Diapensia lapponica*, *Arctous alpina*, *Vaccinium cæspitosum*, *Saxifraga aizoon* var. *rivularis*, *Veronica alpina*, *Geum radiatum* var. *Peckii*, *Sibbaldia procumbens*, *Rhododendron lapponicum*, *Phylloce cærulea*, *Primula farinosa*, *Saxifraga oppositifolia*, *S. aizoon*, and *S. aizoides*, *Aster polyphyllus*, and *Woodсия glabella*; and in the Rocky Mountains and Pacific Coast ranges by *Erigeron uniflorus*, *E. lanatus*, and *E. ursinus*, *Actinella Brandegei* and *A. grandiflora*, *Artemisia borealis*, *A. scopulorum*, and *A. alpina*, *Senecio Soldanella*, *S. Fremontii*, *S. petraeus*, *S. uniflorus*, and *S. werneriaefolius*, *Crepis nana*, *Campanula uniflora*, *Primula Parryi* and *P. suffruticosa*, *Androsace Chamæjasme* and *A. septentrionalis*, *Gentiana prostrata*, *G. frigida*, *G. Newberryi*, *G. Parryi*, and *G. simplex*, *Phlox bryoides* and *P. cæspitosa*, *Polemonium confertum*, *Cassiope Mertensiana*, *Phylloce Breweri*, *Draba streptocarpa*, *D. Parryi*, and *D. nudicaulis*, *Arabis Lyallii* and *A. platysperma*, *Smelowskia calycina*,



3415. A rock-garden bordering a lawn.

Lychnis montana and *L. Kingii*, *Calandrinia pygmæa*, *Claytonia megarrhiza*, *Spraguea umbellata*, *Dryas octopetala*, *Geum Rossii*, *Saxifraga chrysantha* and *S. bryophora*, *Cystopteris alpina*, *Aplopappus pygmaeus*, *A. Lyallii*, and *A. acaulis*, *Omphalodes nana* var. *aretoides*, *Chionophila Jamesii*, and so on. (Not all of these names are accounted for in this work. They may be found in the current manuals of North American plants.)

The uncultivated American plants in this class are quite as numerous and attractive as are the European

species that have been long cultivated there. Here alpine plants have been but little undertaken. A very few easily grown European kinds, as *Aubrietia deltoidea*, *Achillea tomentosa*, *Campanula carpatica*, and *Arabis alba*, are offered by American nurserymen and cultivated in the open border. On a few private places small rock-gardens have been established, or advantage has been taken of favorable local conditions to cultivate some additional species, and in one or more botanic gardens considerable collections have been at times maintained, chiefly in frames. Generally what have passed for rock-gardens have been rockeries—mere piles of cobbles raised from the surface of turf or piled against dry banks in such a manner as rapidly to disperse instead of slowly conserve all soil-moisture. Even the most self-assertive weed fails to thrive in such a garden.

In general, we have a smaller rainfall, less humidity and a larger proportion of sunny days than in England, to which we must look for careful instruction in the cultivation of alpine plants. This must be regarded in the arrangement of our rock-gardens. Every precaution should be taken to secure the full advantage of rainfall and any natural water-supply, and there should



3416. A pocket in the rocks.

also be a liberal and constant artificial water-supply. It must be kept in mind, also, that at low elevations the long hot summers do not allow the period of rest that such plants require. This condition must be met by devices, methods, and locations that will retard the growth in spring, check it at an early period in autumn, and keep the plants fully dormant in winter, such as shade, mulching, and, in the case of particularly difficult plants, the protection of frames. It is essential that conditions be provided that will enable the roots to extend for a long distance, often many feet, in narrow crevices and pockets between rocks to depths where there is a uniform temperature and uniform moisture supplied by moving water, for frequent freezing and thawing and stagnant water are fatal. These cavities should be filled with such loose material as fragments of rock mixed with decayed vegetable matter, without manure, and arranged to provide for the free passage of hair-like roots, for perfect drainage and the free access of air. To provide these unusual conditions on the average private place in a large way would be so difficult and so expensive that it is not to be recommended. A small collection, comprising a few easily cultivated alpine plants and the similar rock-plants referred to in a later paragraph may, however, be successfully grown on reconstructed stone walls, on ledges, in small rock-

gardens and in the open borders of almost any country or city place. Persons who desire to cultivate a large collection of true alpine plants should seek a situation where favorable natural or existing conditions may be taken advantage of. Such locations are likely to be found at the seashore and in rocky and hilly regions—such regions, for example, as are chosen by many persons for summer homes. A ledge, a natural mass of boulders or an abandoned quarry will often provide them. Pockets and crevices of ledges may be cleared of unsuitable material, and if they are not deep enough to hold moisture and have an equable temperature their depth may be increased by the judicious use of wedges, bars, and explosives. Boulders can be arranged in such a manner as to secure suitable deep pockets and crevices of soil, springs can be diverted to supply a constant flow of water, underground pipes can be carried from an artificial source of supply to various points where conditions require them. However favorable the conditions are, it will be found that much can be done to advantage in different localities to meet the special requirements of different groups of plants. In such work, however, it should be kept constantly in mind that there are plants that will grow in all sorts of surroundings, and that it will often be much better to seek such as are adapted to existing conditions than to go to the expense of radically modifying such arrangements.

If an artificial rockery is to be constructed, it should be borne in mind that it is not for the purpose of displaying a collection of curious rocks fantastically arranged, but to provide a place for growing a class of plants that cannot be so well grown elsewhere. It would be better never to think of securing mountain, valley and rock effects in the disposition of the material to be used, but only to think of providing many varied conditions and situations as regards exposure to sun and shade, depth of pockets and crevices, the character and depth of soils, subterranean and surface water-supply, and whether it be permanent or fluctuating. In selecting and arranging the rocks, freshly broken raw faces should not be exposed, but rather such faces as are already covered with a growth of lichens for sunny places and with mosses for shady spots. To take full advantage of surface water, pockets and crevices should have a decidedly downward direction from the exposed surface and not be sheltered by overhanging rock. That this does not apply in all cases, those who are familiar with the habitats of rock-plants know full well. The natural habitat of *Pellaea gracilis* in the upper Mississippi bluffs is in horizontal crevices well back from the edge of the overhanging rock, where it is absolutely protected from all surface water. It finds sufficient moisture in the horizontal seams. *Pellaea atropurpurea* will grow in narrow cracks and small pockets on the face of dry limestone boulders where there can be no possible internal supply of moisture. These examples go to show that the general principles that will apply to such plants as a class will not apply to all species, and it simply gives emphasis to the importance of trying a plant under all sorts of conditions before assuming that it can not be grown. The writer remembers well an attempt to grow that most exquisite alpine flower, *Gentiana verna*, in the open border on a little pile of rocks to give it suitable drainage. It was transplanted a number of times to places where its environment appeared to be about the same, and finally a situation was secured, where, instead of barely holding its own, it increased and produced a number of its great deep blue flower-cups.

The importance of protection from drying and cold winds and of securing shade in many situations must not be overlooked. Sometimes advantage may be taken of an existing deciduous or evergreen tree or shrub growth, or rapid-growing varieties may be planted to make a screen. While shelters of this character are of value about the outer limits of a rock-garden, they can hardly be used for separating its smaller compartments.



3417. An isolated rock-garden under a tree, southern California.

For this purpose, slow-growing dense-foliaged evergreens with a restricted root range are best. This would include the yuccas, a few of the dwarf forms of thuya, juniperus, picea, retinispora and practically all the broad-leaved evergreens. The latter, especially the rhododendrons (of which *Rhododendron maximum* can be secured in large plants at low cost), are particularly useful owing to their habit of growth, restricted root area, and the facility with which they can be moved from place to place as desired. As these shelter-belts and groups form the background and setting of the rock-garden and are the dominating landscape feature in views from a distance, their composition and disposition is a matter of much importance. The disposition must be governed, however, by the general arrangement of the ground, but in this arrangement an agreeably varied sky-line and composition of plant forms and of shades of green should be sought for. In the composition of the background, and in the planting of the rock-garden as well, a decided character should be given to the whole and to each distinct compartment by using some few effective plants in quantity rather than a great number of varieties in small quantities. Variegated and distorted garden freaks should be excluded, for they only distract the attention from the rock-garden, the primary object. Even more inappropriate are statuary fountains and vases.

Up to this point reference has been made for the most part to distinctly alpine plants, that is, plants that are confined exclusively to the region on mountains above the tree- and shrub-line. They are the ones that will test the skill of the cultivator. There are, however, many rock-plants, that is, plants that grow naturally on rocks, or plants having a tufted, matted, and more or less persistent and evergreen foliage similar to alpenes, that can be used with them in less favorable positions in the rock-garden or in the open border. Many of such plants can be readily procured from American nurserymen and collectors. They are easy of cultivation and attractive in habit and flower. The writer would include also low-growing bulbous plants, especially such as have inconspicuous foliage. They may be planted with the low ground-covering plants to push up through them. From this list are omitted such plants as belong more properly in the wild-garden, especially such as spread rapidly by underground shoots and are likely to become a pest. (In a rockery conditions are such that it is almost impossible to extirpate deep-rooting, weedy plants, and they above all others should be rigidly

excluded.) Among desirable rock-plants may be included *Geranium sanguineum*, *G. Andrewsii*, and *G. Robertianum*, *Gypsophila muralis*, *Helianthemum vulgare*, *Helleborus niger*, *Leontopodium alpinum*, *Linaria Cymbalaria*, *Lotus corniculatus*, *Lychnis Viscaria*, *Papaver alpinum* and *P. nudicaule*, *Cerastium Lappaceum*, *Saponaria ocymoides*, *Veronica Teucrium* and *V. rupestris*, *Arabis alpina*, *Campanula fragilis*, *Daphne Cneorum*, species of *Alyssum*. *Bellis*, *Cerastium*, *Arenaria*, *Draba*, *Epimedium*, *Iberis*, *Thymus*, *Arabis*, *Armeria*, *Ajuga*, *Dianthus*, *Sedum*, *Sagina*, *Primula*, *Aquilegia*, *Saxifraga*, *Corydalis*, *Myosotis*, *Semprevivum*, *Parnassia*, *Viola*, *Hepatica*, *Opuntia*, *Houstonia*, *Anemone patens* var. *Nuttalliana*, dwarf and creeping *Campanulas*, *Cornus canadensis*, *Dicentra eximia*, *Calluna vulgaris*, *Iris cristata*, *I. verna*, and *I. pumila*, *Leptophyllum buxifolium*, *Phlox subulata*, *P. amara*, and *P. reptans*, *Saxifraga virginiana*, *Silene pennsylvanica* and *S. virginica*, *Anemone thalictroides*, *Waldsteinia fragarioides*, *Galax aphylla*, *Asperula odorata*, low-growing ferns, mosses, and the like.

For more specific instructions as to the construction of rock-gardens and the care and propagation of rock-plants (for European conditions), see Robinson's "Alpine Flowers," London, 1870, and Sutherland's "Hardy Herbaceous and Alpine Flowers," Edinburgh and London, 1871.

WARREN H. MANNING.

The making of a rock-garden.

A rock-garden must of necessity often be "artificial" in the sense of made by man, because few gardens or grounds contain a natural rocky slope or even a natural bank upon which one might be constructed, and if they did the position may not be an ideal one. A southern slope would be too hot and dry in this climate, unless it was shaded by tall trees. A bank with a northern or northeastern aspect free from the roots of trees would suit this class of plants much better, and very attractive it can be made, especially if the bank is on the outer edge of a garden, or skirts a lawn. There is no form of gardening in which one has more opportunity to give expression to his natural taste than in the construction and planting of a rock-garden. But since all grounds or gardens do not have a natural bank or slope upon which an "open" rock-garden might be



3418. A picturesque rockwork for the wilder parts of the grounds (European).

constructed, a depressed rock-garden may be made in grounds that are perfectly level, and some of the best rock-gardens in the world are what are known as "underground," for example, the one in the Royal Botanic Gardens, Kew, London, England. Before this rockery was constructed the ground was perfectly level. A cutting was begun at one entrance, at first shallow,

but gradually deepening till a depth of some 6 or 7 feet was reached, and an average width of about 10 feet at the bottom. All the soil taken out was placed on the top of the slopes, thus still further increasing the height. The cutting was made in a winding manner, not formal or zigzag, but in such a form that when completed, not only would a variety of aspects be secured to suit the requirements of different plants, but each turn should seem to possess a peculiar charm of its own. The whole cutting is perhaps some 200 yards in length. The rocks are placed in the banks in as natural a manner as it would seem possible to place them; now they stand out boldly, almost perpendicular with the edge of the path, then again they recede into hollow recesses. There are not too many rocks, nor yet too few. In one place a cascade falls over the rocks into a small pool which not only provides a habitat for aquatic and bog-plants, but also adds greatly to the beauty of the rockery. For the convenience of the public, a broad gravel path runs through the whole rockery. Rhododendrons and other shrubs are planted on top of the banks in groups, and not in straight lines, while behind these, for protection and shade, are planted pines and other conifers, as well as some deciduous trees. The rocks were placed in most cases so as to form "pockets" of good size into which the plants could be placed, and the soil made in the pocket to suit the requirements of the different plants. With such a variety of aspects and conditions, this rockery is able to accommodate one of the largest collections of alpine and rock-plants in the world. Deep carpets of mossy saxifrage, aubrietia, arabis, cerastium, sedum, and the like, hang over projecting ledges of rocks, while in fissures and holes in the rocks are growing those dainty rosette-making saxifrages, *S. longifolia*, *S. Cotyledon*, *S. crustacea*, and *S. czesia*, as well as the charming androsaces. In the deeper recesses of the rockery are to be found the large-leaved saxifrages, such as *S. crassifolia*, *S. ligulata*, *S. Stracheyi*, and *S. purpurascens*. Quite at home and in suitable positions are alpine primulas, auriculas, and cyclamens. There are Iceland poppies, Himalayan poppies (*Meconopsis Wallichii* and *M. nepalensis*), gentians from the tiny blue *Gentiana verna* to the tall *G. septemfida*, and many kinds of Hosta, Fritillaria, Erica, Epimedium, Cypripedium, Orchis, Lilium, Erythronium, Allium, Alyssum, Ajuga, Achillea, Armeria, Sagina, Sempervivum, and creeping Veronica, besides other plants too numerous to mention. Particularly prominent positions, as on top of the rocks, or at a turning point in the path, are occupied by some stately plant, such as *Rheum palmatum*, *Acanthus mollis*, or *Gunnera manicata*, or *G. chilensis*, while foxgloves, ver-

bascums, and such plants would fill up the recesses in the shrubs on the top of the rockery. One end of the rockery beneath the shade of overhanging trees is devoted to hardy ferns, which grow with wonderful luxuriance. With the variety of rare and interesting plants, together with the artistic yet natural appearance of the whole rockery, a more beautiful place it would be difficult to conceive.

In 1898, the writer built a rock-garden in the Botanic Gardens of Smith College, Northampton, Massachusetts, somewhat after the pattern of the one at Kew, but on a very much more limited scale. (Fig. 3419.) The position chosen (the only one available) is near the outskirts of the garden proper, on what was formerly a grassy southern slope. A cutting was made through the slope in much the same manner as the one at Kew, but to secure good northern aspects the soil was all banked on the southern side. The path, which is quite level, varies in width from 3 to 6 feet. The height of the banks in which the rocks are placed ranges from 2 feet at the entrances to some 8 or 10 feet at the highest point. For rocks, large water-worn boulders collected in the vicinity were used. One shaded recess, with a northern aspect, is devoted to native ferns, which at the present time, 1916, comprises some forty species. The whole rockery outside is banked with flowering shrubs, and on the southern bank outside are planted some trees, chiefly catalpas, for the purpose of shading the southern aspect of the rockery, as well as for ornament. Water is laid on so that the plants might not suffer in dry weather. The writer has not been successful with alpine primulas, mossy saxifrages, tufted gentians and several other subjects which delight in a cool, moist climate, perhaps from his not having provided the ideal conditions for such plants, but more probably due to our extremes of climate. Still there is a large variety which does well here. The writer has found most of the low-growing veronicas, sedums, sempervivums, arabises, alyssums, achilleas, alsines, erysimums, aquilegias, campanulas, stellarias, pachysandras, the beautiful shrubby little *Daphne Cneorum*, and many others, do very well in the more sunny or southern aspects of the rockery, while on the northern aspects cerastiums, iberises, ajugas, Iceland poppies, rosette and large-leaved saxifrages, moss pinks, epimediums, herniarias, arenarias, cardamines, armerias, dianthus, native orchises, cypripediums, and many other plants do well. On the top of the rockery, to fill in recesses in the shrubbery, are planted foxgloves, verbasiums, and tall veronicas, while at conspicuous points are planted clumps of *Boronia cordata*, *Buphthalmium speciosum*, *Aruncus sylvestris*, or any herbaceous plant which looks well as an

isolated specimen. In among the plants in irregular colonies are planted hardy bulbs, such as crocuses, scillas, ornithogalums, narcissi, snowdrops, chionodoxas, and grape hyacinths; these come up the first thing in the spring and blossom before the other plants get well started into growth, and are a decided acquisition to a rockery.

Almost all alpine plants may be readily propagated by seed, cuttings, or division of the plants. A good plan is to sow the seeds in 4-inch pots early in February in a finely prepared light soil, and place the pots in a moderately warm greenhouse; here they soon germinate, and as soon as large enough to handle they are transplanted either into other pots similarly prepared, or into small shallow boxes. They grow vigorously through the early spring months, and by the first of



3419. Entrance to the sunken or "underground" rock-garden.—Botanic Gardens, Smith College, Northampton, Massachusetts.

May they may be planted out permanently. Seeds may also be sown in a shaded frame in spring and the plants transferred to the rockery in autumn.

In planting a newly made rock-garden, it is a mistake to plant too thickly. Each plant should be given sufficient space for a reasonable growth, and to show its true character. Compact-growing and tufted plants may be planted closer than those of a spreading habit. All variegated-leaved varieties and plants having an aggressive habit or that cannot easily be kept within reasonable limits should be rigorously excluded from a rock-garden. The whole rock-garden should be replanted and fresh soil placed in the pockets about every four or five years. In dry weather a thorough watering should be given at least once in two days, and, as in other parts of a garden, weeds will insinuate themselves wherever they can gain a foothold; these, of course, should be removed as soon as they appear. In winter, the plants in the most exposed positions, such as those which overhang ledges of rocks, should be protected by branches of hemlock or pine laid lightly over them, and a light covering of half-decayed leaves or manure placed between most of the plants, especially on a southern exposure, protects them from excessive thawing and freezing. The general care required is usually much less than for an ordinary flower-garden, but the pleasure to be derived from a well-constructed and well-planted rock-garden is very much more.

EDWARD J. CANNING.

RODGERSIA (named in honor of Commodore Rodgers, United States Navy). *Saxifragaceæ*. Hardy herbaceous perennials suitable for garden planting, with showy terminal flower-clusters.

Rootstocks horizontal, thick and black; lvs. alternate, large, peltate or digitately or pinnately compound, usually dark green; infl. tall and variously compound, paniculate; fls. very numerous, small; calyx-lobes 5; petals usually none; ovary 2-3-celled.—About 8 species, China and Japan. Botanically *Rodgersia* is close to certain species of *Astilbe*, having 10 stamens and no petals; it differs in having connate carpels, scorpioid infl. and 5-cut rather than thrice-ternate foliage.

Perhaps the best-known species is *R. podophylla*, as it was the first introduced into cultivation. It grows 3 to 4 feet high, and the leaves are finger-shaped, the five lobes being bold in outline, angled, and serrate. In the spring the foliage is light green; in summer it assumes a metallic bronzy hue. The plant is a vigorous grower, and under favorable circumstances has been known to make a clump 9 feet in diameter, the largest leaves being a yard across and borne on stalks 3 feet long. The flowers are borne in midsummer on stalks 4 to 5 feet high. The general style of inflorescence is that of the popular *astilbe*, to which it is closely allied. The flowers are very small, but make a feathery spray of fluffy white bloom. The panicle is a foot or more long and as wide at the base. Technically the flowers have no petals; what seem to be petals are the white calyx-segments. As a flowering plant it has been said by enthusiasts to be superior to *astilbe*, but the bloom is scantier, rather greenish at first, and perhaps does not last so long. It may not be so amenable to forcing. *Rodgersia* is a native of the subalpine regions of Japan and is presumably hardy in our northern states. It is offered by importers of Japanese plants. The plant is highly esteemed by English connoisseurs, but seems to be nearly unknown to American gardens. Although any deep rich garden soil will do, it is said to prefer a moist peaty soil. It should be placed in a sunny position, with plenty of room, where high winds cannot damage it. Easily propagated. (Wilhelm Miller.)

æsculifolia, Batalin. About 2½-6 ft. high: lvs. large, basal as much as 18 in. across, digitately compound, usually 7 lfts.; lfts. 4-10 in. long, narrowed to the

base, coarsely toothed; infl. 1½-2 ft. long, composed of flat clusters of white fls.; sepals rounded or blunt at apex: petioles, peduncles, and principal veins of lvs. covered with shaggy brown hairs. China.—The lvs. are like those of the horse-chestnut.

pinnata, Franch. Fig. 3420. Tall simple-branched, 3-4 ft. high, with a large horizontal rootstock: st. hollow: lvs. long-petioled, digitately pinnate; lfts. 5-9, 6-8 in. long, obovate or oblanceolate: fls. in a large much-



3420. *Rodgersia pinnata*.

branched panicle with rose-red rachis and branches; calyx puberulous, lobes ovate, red outside, white within. B.M. 7892. G.C. III. 32:131. G.M. 54:592. Gn. 73, p. 531; 76, p. 378. Var. *alba*, Hort., differs from the type in somewhat longer and broader panicles, the component parts of which are clustered more loosely: fls. white. China. G. 28:147. Var. *superba*, Hort., is much finer than the type, with the infl. more than 1½ ft. long: fls. delicate rose: fr. dark red. China.

podophylla, Gray. Herb with a thick scaly rootstock, 2-3 ft. high: basal lvs. few, long-petioled, peltately 5-foliolate, 6-18 in. diam.; lfts. sessile, 5-10 in. long, 3-8 in. broad, cuneately obovate or almost deltoid to above the middle, then trifid; margin coarsely serrate; cauline lvs. few, smaller, commonly 3-foliolate or 3-lobed: infl. a large panicle composed of scorpioid cymes; fls. small, yellowish white calyx-lobes spreading-ovate: caps. very small. China. B.M. 6691. G.C. II. 20:141. G. 13: 239; 21:531; 35:67 and 431. Gn. 36, p. 171; 38, p. 125; 46, p. 34. G.M. 33:477. G.W. 5, p. 193. R.H. 1908, p. 15.

sambucifolia, Hemsl. About 2-3 ft. high: basal lvs. 9-15 in. long, long-petioled, bright green; lfts. in 3-5 widely separated pairs with an odd one at the top; the cauline lvs. solitary or 2 uneven pinnate, 9-11-foliolate; lfts. subsessile, subopposite and oblong-lanceolate: infl. small, terminal, densely cymose, paniculate; fls. white, small, and inconspicuous; sepals fleshy, ovate, sub-acute. China. G.C. III. 54:131.

tabularis, Kom. Herb, about 3 ft. high: lvs. very long-petioled, peltate, 1-3 ft. diam., shortly many-lobed, resembling teeth, the lobes broad-acuminate, usually sparingly setulose: infl. scapose, many-fld., resembling an *astilbe*; fls. small, white; calyx-lobes 5, broad obovate-oblong, rounded; petals 5, obovate-oblong. China. G.C. III. 44:210; 54:130. G. 35:829. Gn. W. 25:648.

F. TRACY HUBBARD.

RODRIGUEZIA (Emanuel Rodriguez, Spanish botanist and apothecary). Including *Burlingtonia*. *Orchidaceæ*. South American epiphytic orchids, a few of which are cultivated for graceful racemes of delicate flowers.

Pseudobulbs small, compressed, 1-2-lvd. and bearing

sheathing lvs. at the base; racemes erect or pendulous; dorsal sepal and petals similar, free, erect; lateral sepals united, concave, but scarcely saccate; labellum spurred or saccate, with a long claw parallel to the column, and a spreading blade usually exceeding the sepal; column slender. Robert Brown's genus *Gomesa* (sometimes written *Gomeza*), founded on *G. recurva*, is by some referred to *Rodriguezia*. See *Gomesa*. The fls. are nearly always fragrant. The plants vary somewhat in habit. Some species form neat, compact tufts, while others, like *R. decora*, have long, straggling rhizomes difficult to keep within the limits of a block or a basket.

Rodriguezias should be grown in very shallow pots filled with tough peat, and well drained. Rest them in a temperature of 50°, giving little water. The growing temperature should be from 65° to 75°. Give plenty of moisture and shade from direct sunshine. The stronger-growing kinds will need thicker potting material in baskets; they do well wired on tree-fern stocks. During growth, syringing is necessary. (Wm. Mathews.)

A. Fls. large, white, spotted or rose.

B. Raceme erect.

decora, Reichb. f. (*Burlingtônia decora*, Lem.). Plant with a long, slender rhizome, with oval, 1-lvd. pseudobulbs; scape nearly erect, 9 in. high, bearing 5-10 blossoms in a loose raceme; sepals and petals ovate, acute, connivent, white or pale rose spotted with red; labellum



3421. *Rodriguezia secunda*. (× 1/2)

twice as long as the petals, white; middle lobe rounded, bifid, contracted into a broad claw which has several fringed lamellae; column with falcate hairy ears. May, June. Brazil. B.M. 4834. F.S. 7:716. Var. **picta**, Hort. (*Burlingtônia decora* var. *picta*, Hook.). Pseudobulbs orbicular, compressed; fls. short, acute; sepals and petals spotted with deep purple-red. B.M. 5419.

BB. Raceme pendulous.

venusta, Reichb. f. (*R. fragrans*, Reichb. f. *Burlingtônia venusta*, Lindl. *B. fragrans*, Lindl.). Lvs. linear-oblong, forming compact masses; fls. in drooping racemes, large, white, or tinged with pink and having a yellow stain on the lip; dorsal sepal acute, the lateral pair entire; labellum transversely plicate near the middle. Flowers at various seasons. Brazil. I.H. 5:188. G.C. III. 4:757.—Very near *R. candida*.

candida, Batem. (*Burlingtônia candida*, Lindl.). Lvs. oblong, firm; racemes pendulous, 4-6-fl.; fls. white, with a light stain of yellow on the labellum, 2 in. long; dorsal sepal obovate, emarginate, the lower pair united into a concave, bifid blade, saccate at base; petals obovate, with the apex recurved; labellum with a broadly

cuneate, bifid middle lobe, longer than the sepals and petals; base and lateral lobes parallel to the column, throat with many lamellae. April, May. Guiana. B.R. 1927. F.M. 1871:548.

pubescens, Reichb. f. (*Burlingtônia pubescens*, Lindl.). Lvs. tufted, dark green, keeled; racemes many, pendulous, from the tuft of lvs.; fls. pure white; labellum 2-lobed, hastate; lateral lobes erect, with lamellae; column pubescent, in which it differs from other species.

AA. Fls. small, deep rose or spotted red.

secunda, HBK. Fig. 3421. Pseudobulbs bearing several thick, linear-oblong lvs.: raceme erect, secund, 6 in. high; fls. deep rose; sepals erect, ovate, convex, the lower pair keeled and gibbous; petals like the dorsal sepal; labellum obovate-oblong, emarginate, scarcely longer than the sepals. Aug. Trinidad, Guiana. B.M. 3524. B.R. 930. L.B.C. 7:676 (as *R. lanceolata*).

crispa, Lindl. Pseudobulbs elongate-ovate; lvs. oblong-lanceolate, spreading, undulate; raceme pendulous, rather dense; fls. green, with yellowish borders; sepals all free, undulate-crisp; petals similar; labellum lanceolate, sigmoid. Brazil. B.R. 26:54.

AAA. Fls. greenish.

planifolia, Lindl. Pseudobulbs clustered, compressed; lvs. lanceolate; raceme long, drooping; fls. greenish yellow, fragrant; sepals oblong, waved, acute, the lower pair united except at the end; petals like the dorsal sepal; labellum broadly oblong, acute, reflexed, shorter than the petals. Feb. Brazil. B.M. 1748 (as *Gomesa recurva*) 3504. L.B.C. 7:660 (as *Gomesa recurva*). See also p. 1354.

HEINRICH HASSELBRING.

RETTLERA, also spelled *Rottilera*: *Chirita*.

ROGIERA: *Rondeletia*.

RÖHDEA (Mich. Rohde, physician and botanist of Bremen). Sometimes spelled *Rhodea*. *Liliaceae*. A monotypic genus of Japan and China, essentially a tender foliage plant with numerous radical lvs. 6-18 in. long; fls. borne among the lvs. in short thick dense spikes a few inches high; perianth globular-bell-shaped; anthers sessile; stigma peltate; style nearly wanting; fr. a globular, usually 1-seeded berry. *Rohdeas* are excellent plants for dwelling-house decoration, doing well in the cooler positions. They are perfectly hardy at Washington.

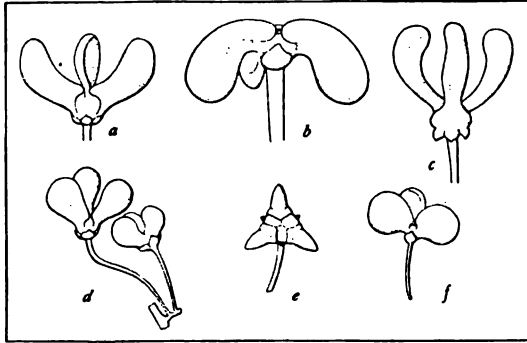
japonica, Roth. Root a long nearly cylindric rootstock with fleshy fibers; lvs. typically green, 9-12 in. a rosette, erect, oblanceolate; berry about the size of a small olive, with a red pulp. B.M. 898 (as *Orontium japonicum*). Gn. 30, p. 541.—The following varieties, which differ in shape and color of the lvs., have been offered by Dutch bulb-growers: Vars. **aureo-striata**, **falcata**, **latimaculata**, **macrophylla**, **marginata minor**, **pygmaea**, **zebrina**.—This plant known as *Omoto* or *Mannensei* is a favorite among the Japanese, and fine specimens often bring as much as \$500, even when only a few inches high. The seven standard varieties of Japan are *Hinomoto*, *Nagashima*, *Kyuanji*, *Shikami*, *Daimyōsei*, *Jindai*, and *Akitsuishima*. Retired persons of means often spend their declining years in the culture of this interesting plant, of which hundreds of named varieties are known to Japanese fanciers. A number of very beautiful books have been written on this plant, and it has an extensive literature. This plant is well known in China and was adopted by the Manchus as their national flower.

L. H. B.†

ROLLINIA (named in honor of the French historian, Charles Rollin). *Annonaceae*. BIRIBÁ. ARATICÚ. CACHIMAN. Tropical American shrubs and trees.

Fruits fleshy, compound, subglobose, resembling those of *Annona*, but with fls. very distinct in form from those of *Annona*: corolla gamopetalous with the lobes corresponding to the outer petals of *Annona* pro-

duced into 3 rounded wings or obtuse spurs, in some species horizontally projecting, in others curved upward and inward, in others outward and downward; lobes corresponding to the 3 inner petals, alternating with the winged or spurred lobes, reduced to minute scales, almost closing the opening above the essential



3422. Types of *Rollinia* flowers. a, *R. Sieberi*; b, *R. deliciosa*; c, *R. laurifolia*; d, *R. rugulosa*; e, *R. lanceolata*; f, *R. emarginata*.

parts. The type species is *R. dolabripetala*.—The genus, including about 50 species, ranges from Mex. and the W. Indies southward to Argentina and Peru. It is well represented in Brazil and Paraguay. In some of the species the frs. are highly prized for the table and rival the cherimoya, for which they have sometimes been mistaken. Several have been intro. into cult. through the Miami (Fla.) Station by the Office of Foreign Seed and Plant Introduction, U. S. Dept. of Agric. Much confusion has resulted from the fact that in many original descriptions of species of *Rollinia*, the frs. were not included, and that edible frs. in the markets unaccompanied by lvs. or fls. have in many cases been botanically misidentified. It is impossible here to give a key to all the species. The principal ones may be grouped according to the form of the fl. into sections or subdivisions, as indicated in the accompanying illustration (Fig. 3422).

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A. Corolla-wings oblong, laterally compressed, widely spreading and more or less ascending. (Fig. 3422, a.)

1. *dolabripetala*, St. Hil. (*Annona dolabripetala*, Raddi. *Rollinia longifolia*, St. Hil.). HATCHET-LOBED ROLLINIA. A small tree, 16½–23 ft. high: young branches, together with the lower surface of the young lvs., their petioles, and the fls. ferrugineous-tomentose: vegetative lvs. oblong-lanceolate or oblong, 4–6 in. long and about 1½ in. broad, those of the flowering branches much smaller, acutish or acute, or sometimes subacuminate at the apex, obtuse at the base, glabrous above, rufous-pubescent beneath, with the midrib prominent beneath, ferrugineous, with 20–28 lateral nerves; petiole about ½ in. long, grooved above, persistently ferrugineous-tomentose: peduncles solitary or rarely in pairs, ferrugineous-tomentose, bracteolate at the base, ½–1½ in. long: calyx-divisions cordate-ovate or suborbicular; corolla-wings rather fleshy, 1 in. long, ferrugineous-tomentose, laterally compressed in the form of a hatchet or broad knife with its blade in a vertical plane, at first ascending, at length broadly spreading: fr. (immature) globose, squamose, pubescent, with the areoles slightly convex; seeds compressed, somewhat cuneate, testa reddish yellow, thin, showing

the wrinkles of the inclosed ruminant endosperm. This species, the type of the genus *Rollinia*, was first collected on Mt. Corcovado, near Rio de Janeiro, Brazil, where its fls. appeared in Feb. and its fr. in May.

2. *mucosa*, Baill. (*Annona mucosa*, Jacq.). CACHIMAN MORVEUX. A small tree first described by Jacquin from specimens growing spontaneously in the forests of Martinique, and said by him to be rarely cult. In habit it bears a close resemblance to the common custard-apple, *Annona reticulata*. Lvs. oblong, pointed at the apex and base: corolla gamopetalous in the form of a roundish body from which 3 oblong lobes spread outward in such a way that it not inaptly represents a tricornered hat: areoles of fr. gibbous (convex) not papillose nor aculeate; fleshy pulp very viscous and not very well flavored.—*R. Sieberi* has been referred to this species, but Père Duss, in his Flora of the French Antilles has kept the two species distinct.

3. *Sieberi*, A. DC. CACHIMAN MONTAGNE. A small tree first described and figured from the island of Trinidad and erroneously referred by its collector to the common custard-apple, *Annona reticulata*, to which its fr. and lvs. bear a certain resemblance: lvs. oval-oblong, acute at apex and base, usually 5–6 in. long and 2–3 in. broad, thin, above puberulous with the nerves pilose, beneath paler and more pilose, narrowed at the base into pilose petioles ¼ in. long, some of them at the base of the branches broadly ovate and obtuse, about 1 in. long: peduncles lf.-opposed, 1-fl., 1–1½ in. long, bearing 2 small ovate-acute bracteoles, one near the base, the other about the middle: corolla-wings laterally compressed, linear-oblong, rounded at the apex, diverging, straight or curving slightly upward: fr., according to Père Duss, usually larger than that of *Annona squamosa*, the surface divided into pronounced raised squamose



3423. *Rollinia deliciosa*. (× ¼)

areoles rounded at the tips; pulp fleshy, nearly white, melting in the mouth, slightly viscous, with a sugary agreeable flavor. Type collected by Sieber (No. 96), in the De Candolle Herbarium.

AA. *Corolla-wings laterally compressed, widely spreading and more or less decurved.* (Fig. 3422, b.)

4. *deliciosa*, Safford. BIRIBA. Fig. 3423. A tree yielding a delicious, large, juicy fr., resembling the cherimoya: vegetative lvs. obovate-oblong or elliptical, rounded at the base and normally acuminate at the apex, blades 8–11 in. long and 3–4 in. broad, membranaceous, when young sparsely canescent-hirtellous above, densely so beneath, especially along the midrib and nerves, at length glabrous above and beneath except along the midrib and primary nerves (18–22 on each side), these reddish brown and slender but prominent



3424. *Rollinia Jimenezii*. ($\times \frac{1}{2}$)

beneath; petiole about $\frac{3}{8}$ in. long; lvs. on flowering branches smaller, the lowermost ones relatively shorter and broader, sometimes broadly ovate or orbicular, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long and $1\frac{1}{2}$ –2 in. broad; peduncles lf.-opposed, often in pairs, sometimes solitary, rarely in 3's, $1\frac{1}{2}$ – $1\frac{3}{4}$ in. long, bearing a small ovate sessile bracteole near the middle, strigillose with reddish hairs, like the petioles and nerves of the lowermost lvs. (prophylla) beneath; calyx and corolla canescent-puberulous; corolla-wings compressed laterally, widely diverging and decurved, rounded at the extremity; stamens numerous, closely crowded, the expanded connectives forming a pavement above the pollen-sacs; carpels numerous, ovaries hairy, styles expanded, glandular-puberulous; fr. a solid depressed subglobose syncarpium, 3–5 in. diam. with the areoles distinctly outlined and terminating in an obtuse beak; peduncle straight and woody, about 2 in. long; pulp fleshy, white or cream-colored, juicy, fine-flavored; seeds compressed, $\frac{3}{8}$ – $\frac{1}{2}$ in. long and $\frac{1}{8}$ – $\frac{1}{4}$ in. broad, rounded at the apex, gradually narrowing to the base, hilum not prominent; testa thin, brown, wrinkled by the inclosed ruminate endosperm.—The type of this species, in the U. S. National Herbarium, is from a fr.-bearing tree cult. in

the experiment station, Miami, Fla., grown from seeds sent by C. F. Baker from Para, Brazil (No. 22512) in 1908. Baker describes it as the finest annonaceous fruit of Trop. Amer. It was incorrectly referred to *R. orthopetala*, but it is readily distinguished from that species by the decurved wings of its fls.

5. *Pittieri*, Safford. A tree resembling *R. deliciosa*, but with lvs. more abruptly acuminate and glaucous beneath, the vegetative ones 6–8 in. long and $3\frac{1}{4}$ in. broad, midrib and primary nerves (16–20 on each side) reddish brown beneath: lvs. on flowering branches smaller (with 10–12 primary nerves); peduncles often in clusters of 3 or 4, graduated in length, the longest $1\frac{1}{2}$ in. long, rufous, minutely puberulent, never hairy like those of *R. deliciosa*, bracteolate near the middle: corolla-wings $\frac{3}{8}$ – $\frac{1}{2}$ in. long, falcate, horizontally extended and decurved, rounded at extremity, and narrowed at the base, very finely puberulent, appearing under the lens as though composed of olive-gray felt: fr. not observed.—A beautiful species with elliptical or obovate lvs. remarkable for the pale color of the lower surface and the sharply outlined lateral nerves. These correspond with the description of *R. rufinerva*, Triana and Planch., but the corolla-wings are decurved, not "divergent ascending," as in that species. The type, in the U. S. National Herbarium, was collected near Puerto Obaldia, Panama, by Henry Pittier (No. 4358), in whose honor the species is named.

6. *Jimenezii*, Safford. ANONILLA. Fig. 3424. A small tree of Costa Rica resembling *R. mucosa* but with fls. in clusters of 2 or 3, having the corolla-wings horizontally spreading and slightly decurved, and with fr. resembling that of the common sugar-apple (*Annona squamosa*), with the component carpels rounded at the tips when fresh, but more or less beaked when dry: lvs. ovate to oblong-elliptical, acuminate, those of the vegetative branches 7–8 in. long and $2\frac{1}{2}$ –3 in. broad, obtuse at the base, with 18–22 primary nerves on each side of midrib, those of the flowering branches smaller with 12–16 pairs of primary nerves and usually rounded at the base; point of acumen either acute or more usually obtuse or retuse; young branches, petioles, and lower surface of young lvs. covered thickly with ferruginous hairs, lvs. at length glabrous or nearly so except along the midrib and nerves beneath: peduncles lf.-opposed, in clusters of 2 or 3, graduated in length, the longest about $\frac{1}{2}$ in. long, ferruginous-tomentose like the ovate-acuminate calyx-lobes: corolla-wings oblong, rounded at the tip, scarcely at all narrowed at the base, widely spreading and usually decurved, never curving upward and inward, rufous-puberulent: fr. subglobose, about $2\frac{1}{2}$ in. diam., closely resembling that of *Annona squamosa*, the component carpels loosely adhering, very gibbous, rounded or often retuse at the tip when fresh; pulp white, edible, but not so agreeably flavored as that of *Annona squamosa*.—This species is based upon specimens in the U. S. National Herbarium, received from Oton Jimenez, of San José, Costa Rica, the fls. collected by him at Nuestro Amo, March, 1912 (No. 427), and the fr. from the same tree, Oct., 1912. The accompanying figure is drawn from type material, the fr. from a field photograph sent by Mr. Jimenez, in whose honor the species is named.

AAA. *Corolla-wings linear-oblong or spatulate, ascending or erect and incurved.* (Fig. 3422, c.)

7. *orthopetala*, A. DC. A shrub or small tree with the habit of *R. Sieberi*, but with the lvs. somewhat longer petioled: lvs. oval-oblong, acute at apex and base, pilose: peduncles in pairs: calyx-lobes smaller than in *R. Sieberi*; corolla-wings erect and incurved: fr. not described.—This species was described by De Candolle from a specimen in the De Candolle Herbarium collected by Parker near Demarara, British Guiana. The name has been incorrectly applied to several rollinias with edible fr. Of these the principal

species, from an economic point of view, is *R. deliciosa* described above, which is readily distinguished from *R. orthopetala* by its widely spreading decurved corolla-wings.

8. *laurifolia*, Schlecht. ARATICÚ MIRIM. A shrub or small tree with the new branchlets, petioles, peduncles, midrib, and nerves finely appressed-subfurfuraceous puberulent, the fls. and lower surface of the lf. clothed with finer and denser clay-colored puberulence: lvs. oblong-elliptical or oblong-lanceolate, acuminate, obtusish at the base, $3\frac{1}{4}$ –5 in. long, $1\frac{1}{4}$ – $1\frac{3}{4}$ in. broad; midrib prominent beneath, lateral nerves 10–15 pairs; upper surface apparently glabrous, but as seen under a lens covered with minute appressed white hairs: peduncles solitary or in 2's or 3's, graduated in length, the longest 3 times as long as the petioles (1 in. long), bracteolate at the base, gradually thickening toward the apex: corolla-wings ascending-erect, broadened at the apex, rounded or quite obtuse, $\frac{3}{4}$ in. long and $\frac{1}{4}$ in. broad near the apex, clothed with minute brownish-argillaceous tomentum: fr. subglobose, about the size of a horse-chestnut, composed of many carpels distinctly outlined and containing an edible, white, mucilaginous pulp with a pleasant sweet taste.—This species is based upon 2 flowering specimens collected in Brazil by Sellow (Nos. 809 and 1190).

9. *incúrra*, Moore. A diffuse shrub with long branches: lvs. short-petioled, lanceolate or lanceolate-oblong, obtuse, rounded at the base, coriaceous, above glabrous, often glossy, beneath paler, minutely puberulous, blades 4–5 in. long, $1\frac{1}{4}$ –2 in. broad, often more or less oblique at the base; midrib impressed above, rather prominent beneath, lateral nerves about 12 pairs inserted at a wide angle, undulate near the margin and curving upward: peduncles usually in pairs, sometimes solitary, longer than the petioles ($1\frac{1}{4}$ in. long), bracteate at the base, and bearing a small bracteole near the middle, puberulous: fls. yellowish green; calyx-lobes short and rounded, ferruginous-pubescent; corolla-wings ferruginous-tomentose, spatulate-oblong, ascending and incurved, $\frac{3}{4}$ in. long; stamens numerous, crowded; carpels albo-sericeous: fr. not observed.—This species described by Spencer Moore, was collected in Santa Cruz, Brazil, by the Matto Grosso expedition. Specimens from the type collection are in the Herbarium of Columbia University, at the Botanical Garden, New York City.

AAAA. Corolla-wings compressed, obovate, and ascending.

(Fig. 3422, d.)

10. *rugulosa*, Schlecht. A shrub or small tree: lvs. lanceolate, or broadly lanceolate, obtusely and shortly acuminate, acute at the base, on both sides subglabrous, beneath glossy; young branchlets, petioles, and midrib appressed-puberulous: peduncles usually recurved or pendulous and thickened at the apex, warty and puberulous like the calyx, $\frac{1}{4}$ – $\frac{3}{4}$ in. long: corolla-wings obovate, ascending, rounded or obtuse at the apex, narrowed at the base, tomentose-canescens, $\frac{1}{4}$ in. long and $\frac{1}{4}$ in. broad: fr. globose, 1– $1\frac{1}{4}$ in. diam., with the component carpels forming 20–30 slightly raised rounded areoles; seeds small, pale brown, conoid, somewhat flattened.—Type collected in S. Brazil by Sellow. Closely related to *R. rugulosa* and with very similar fr. but with longer and narrower lvs. (suggesting those of *R. salicifolia*), is *R. Warmingii*, R. E. Fries, the type of which was collected on Mt. Tijuca, near Rio de Janeiro, by Glaziou (No. 6079).

AAAAA. Corolla-lobes or -wings short, straight and spur-like, horizontally directed. (Fig. 3422, e.)

11. *lanceolata*, R. E. Fries. A small tree with small lanceolate lvs.: lvs. acute at the apex and base, above glabrous except along the midrib; beneath densely ferruginous-villous along the midrib: young branches, petioles, and solitary or rarely geminate peduncles fer-

rugineous-tomentose: fls. ferruginous-hirsute; outer corolla-lobes spur-like, short, rounded, and widely spreading: fr. not observed.—This species is based by Robert E. Fries on a specimen in the Copenhagen Herbarium collected by Glaziou in Brazil (No. 13509).

AAAAA. Corolla-lobes or -wings broadly ovate or suborbicular, and compressed. (Fig. 3422, f.)

12. *emarginata*, Schlecht. A glabrescent shrub, $6\frac{3}{4}$ –10 ft., growing in marshy places, with slender branches: lvs. oval or elliptical, obtuse at both ends or acutish at the base, emarginate or retuse at the apex, on both sides subglabrous and opaque: peduncles usually solitary, slender, about 1 in. long, minutely bracteolate at the base: corolla and calyx silky-hirtellous; corolla-wings obovate-orbicular, widely spreading, laterally compressed: fr. solid, about 1– $1\frac{1}{4}$ in. diam., ovate-globose, with the component carpels scarcely at all raised or distinctly outlined.—This species, very common in S. Brazil and Paraguay, is based upon specimens collected in the province of Rio Grande do Sul by Sellow.

13. *glaucescens*, Sond. A glabrescent shrub closely allied to *R. emarginata*, but with the lvs. not emarginate and sometimes acute at the apex: lf.-blades ovate or lanceolate, obtuse or rarely acute at the apex, acute at the base, 2–3 in. long and 1 in. broad, glaucescent beneath; petioles $\frac{1}{4}$ – $\frac{3}{4}$ in. long: peduncles in pairs, one shorter than the other, the longer one bearing a small bracteole below the middle: fls. canescent-puberulous; corolla-wings broadly obovate or suborbicular, widely spreading: fr. broadly ovoid or subglobose, small (about 1 in. diam.), solid and smooth, with the component carpels scarcely outlined and not at all gibbous.—Specimens in the U. S. National Herbarium collected by Dorsett, Shamel, and Popenoe, in S. Brazil.—This species was based by Sonder on a plant collected by Regnell on his second expedition, in the province of Minas Geraes, Brazil.

14. *sylvatica*, St. Hil. ARATICÚ DO MATO. A medium-sized tree: lvs. elliptical or oblong, shortly acuminate, acute, or obtuse at the apex, acutish at the base, above puberulous when young, at length glabrous, beneath softly tomentose; petiole, midrib, and veins clothed with ferruginous hairs, the remainder of the lower surface with white hairs: peduncles solitary or in pairs, clothed with ferruginous tomentum; corolla-wings suborbicular: fr. globose, solitary, the size of a small apple, pubescent, with the component carpels forming prominent pentagonal areoles; pulp edible, somewhat like that of the cherimoya.

W. E. SAFFORD.

ROLLINIOPSIS (Greek derivative, signifying *Rollinia*-like, from the form of the fl.). *Annonaceae*. FRUCTA DE MACACO. MONKEY-FRUIT. Shrubs or small trees of Brazil having fragrant 3-winged fls. like those of *Rollinia*, but with aromatic frs. in the form of a cluster of small distinct drupes, instead of a fleshy sweet syncarpium, as in *Rollinia*.—Only 4 species have thus far been described, all from Trop. Brazil. The type of the genus (*R. discreta*, Safford), Fig. 3425, has been successfully intro. into cult. in the S. U. S. by the Office of Foreign Seed and Plant Introduction, U. S. Dept. of Agric. (S. P. I. No. 15508). This species, discovered by Dorsett, Shamel, and Popenoe in the vicinity of Januaria, state of Minas Geraes, has orange-colored pear-shaped drupes, locally known as Fruta de Macaco (monkey-fruit). The thin aromatic mesocarp surrounding the solitary seed tastes very much like the fr. of certain species of *Xylopia*, called malaguetas in the vicinity of Panama, and also suggests the flavor of the Mexican *xochinacastli*, or earflower (*Cymbopetalum penduliflorum*) the spicy petals of which, together with vanilla, were used by the Aztecs for flavoring their chocolate in pre-Columbian times (see *Cymbopetalum*). The other known species are *R. simidrum*, Safford, recently discovered by Rose and Russell, of the Carnegie

Expedition, in the state of Bahia; *R. parviflora* (Rollinia parviflora, St. Hil.), of Rio de Janeiro; and *R. leptopétala* (Rollinia leptopétala, R. E. Fries), of Piauh, Brazil.—See Journ. Wash. Acad. Sci., vol. 6, p. 1916.

W. E. SAFFORD.

ROMANOVIA (derivation unknown). Also spelled *Romanovia*. *Palmaceae*. A genus founded in G.C. III. 33:245 without generic description. *R. Nicolai*, Hort. A calamus-like palm with mealy down on the sts., long slender petioles without prickles: lvs. pinnate with



3425. *Rolliniopsis discreta*. a, Flower with a portion removed to show the mass of stamens surrounding the cluster of carpels beneath the minute inner petal, or corolla-lobe ($\times 1\frac{1}{2}$); b, a pair of stamens, showing a pair of parallel pollen-sacs beneath the expanded tip of the connective ($\times 5$); c, mature carpels which have fallen off the receptacle ($\times \frac{1}{2}$); d, seed ($\times \frac{1}{2}$).

remote segms., tapering to a wedge-shaped base and with the retuse apex divided irregularly into long acutely pointed lobes, somewhat as in caryota. Habitat not given. G.C. III. 33:suppl. April 25, p. iii.

ROMANZOFFIA (named in honor of Count Nicholas Romanzoff). *Hydrophyllaceae*. Low and delicate perennial herbs with the aspect of saxifrage, suitable for outdoor planting.

Leaves mainly radical, alternate, round-cordate or reniform, crenately 7-11-lobed, long-petioled: infl. scapose, racemosely or paniculately several-fld.; the pedicels filiform; fls. pale pink or purple, varying white; calyx-lobes oblong-linear or lanceolate: caps. retuse, 2-celled or nearly so.—Ten(?) species, Alaska southward to the coast range of Calif.

unalaschkensis, Cham. Rootstock not tuberous: scape erect, 3-5 in. high; the erect or ascending pedicels shorter than the fls.; calyx-lobes herbaceous; corolla very short-funnelform. Unalaska, and one isolated station in N. Calif.

sitchensis, Bong. Rootstocks slender and tuberous: plant sparsely pubescent or glabrate: scape filiform, weak, 6 in. high; the spreading pedicels longer than the fls.; calyx-lobes very glabrous; corolla funnelform. Alaska south to Monterey County, Calif. G. 36:649.

F. TRACY HUBBARD.

ROMNEYA (named for T. Romney Robinson, who discovered it about 1845). *Papaveraceae*. Tall showy herbs or subshrubs used for garden planting.

Stems branching: lvs. petioled, pinnatifid, 2 or 3 pairs of segms.: fls. solitary at the ends of the corymbose branches, large, white and showy, 6 in. across; sepals 3, with a broad membranaceous dorsal wing; petals 6, all alike; stamens very numerous; stigmas numerous, connate at base into a little ring: caps. 7-11-celled, dehiscent to the middle, the valves separating by their margins from the firm persistent placentae.—Two species, Calif. and Mex. Monographed by Fedde in Engler's *Pflanzenreich*, hft. 40 (IV. 104), 1909.

Romneya grows wild in California from San Diego to Santa Barbara County and also in Mexico, and in the wild state it blooms chiefly in June and July, but in cultivation the period of bloom is increased from May to August. In the region of Los Angeles, it is said to thrive best on dry rocky soil and needs only the water it obtains from the winter rains. Romneya can be transplanted safely if cut to the ground before it is lifted and can be raised from seed if the seed is fresh. Raising from seed under artificial conditions is not very satisfactory, however, as it takes a few years between the germination of the seed and blooming of the seedlings.

Romneya is difficult to transplant, due to the scarcity of fibrous roots; in middle California suckers which are produced in great abundance are transplanted without any loss, provided a good firm ball of earth is kept around the stout thick roots in transit, and if the stems are cut well back, almost to the base. At San Francisco it grows luxuriantly in a heavy adobe soil, producing immense flowers. The name Matilija poppy (pronounced Ma-til'i-ha) is the favorite in California. It comes from the Matilija Cañon, Ventura County, where the plant grows in particular abundance. Miss Parsons writes: "Many people have the mistaken idea that it grows only in that region. It is not common by any means; but it is found in scattered localities from Santa Barbara southward into Mexico. It is very abundant near Riverside, and also upon the southern boundary and below in Lower California, where the plants cover large areas. It not only grows in fertile valleys, but seeks the seclusion of remote cañons, and nothing more magnificent could be imagined than a steep cañon-side covered with the great bushy plants, thickly covered with enormous white flowers." Blossoms remain open for many days. (J. Burt Davy.)



3426.
Top sprig of
Romneya
Coulteri.
($\times \frac{1}{4}$)



XCVIII. Romneya Coulteri, the Matilija poppy, one of the most showy of California flowers



Cöhlteri, Harv. **MATILJA POPPY**. Fig. 3426. Sts. flexuous, more branched above: lvs. rather papery than subcoriaceous, somewhat glaucous; the lower trijugate, the lobes lanceolate, the terminal one ovate: calyx rather glabrous, sepals purplish at the apex; petals white, membranaceous, thickened toward the base: caps. spreading, setose. Calif. and Mex. G.C. III. 27:131. G. 8:603; 35:3. Gn. 13:494; 26:400; 29, pp. 207, 211; 46, p. 405; 55, p. 208; 56, p. 239; 57, p. 263; 62, p. 63; 68, p. 89; 76, p. 611. G.M. 43:36. Gn.W. 20:19. G.F. 10:353. F.M. 1877:252. A.F. 5:397. A.G. 19:314 (suppl. April 16, 1898). C.L.A. 1:76.—Though not considered hardy in the eastern states, it has been successfully grown outdoors in northern states.

trichocalyx, Eastw. Sts. stout, erect, more simple above: lvs. subcoriaceous, 3-lobed or 3-dentate: calyx subglobose: caps. appressed setose. Calif. G.C. III. 42:414. G. 35:571; 37:65. Gn. 77:291. G.M. 54:186.

F. TRACY HUBBARD.

ROMULÈA (a name commemorative of Romulus, one of the mythical founders of Rome). *Iridaceæ*. Crocus-like bulbs, suitable for outdoor planting.

Leaves narrow, usually overlapping the fls.: sts. produced, simple or branched: spathe of 2 lanceolate valves: fls. lilac, purple, yellow or pale, always solitary; perianth funnel-shaped, about 1 in. across; ovary 3-celled: caps. globose or ellipsoid.—About 90 species, Medit. region, Trop. and S. Afr. They are closely allied to Crocus, but differ in being less hardy and in having a long peduncle and short fl.-tube. Very little known in cult. in Amer.

A. *Fls. rosy or crimson.*

rosea, Eckl. (*Trichonema rosea*, Ker). Corm globose, $\frac{1}{3}$ – $\frac{1}{2}$ in. thick: lvs. $\frac{1}{2}$ –1 ft. long, setaceous: peduncle 1–6 in. long, 1–3 fld.; outer spathe $\frac{3}{4}$ in. long; perianth with a short funnel-shaped tube with a yellow throat and a red-lilac limb, about 1 in. long, the outer segms. with 3 faint purple stripes outside. S. Afr. B.M. 1225 (as *T. roseum*). F.S. 8:799 (as *R. Celsii*). G.C. III. 58:37. Gn. 79, p. 232. Var. **speciosa**, Baker (*T. speciosum*, Ker), has a larger perianth and outer segms. with 3–5 dark purple stripes of which the outer are feathered. B.M. 1476.

AA. *Fls. yellow or white.*

Clusiæna, Baker (*Trichonema Clusiæna*, Lange). Fls. bright yellow, tipped with lilac. Spain. A white variety has been intro. abroad by Barr.

Macowanii, Baker. Sts. very stout, 1-fld.: fls. bright golden yellow in the lower part, paler upward and sometimes tinged with red; perianth-segms. oblong. S. Afr. G.C. III. 58:35.

R. Bulbocodium, Sebast. & Mauri(?), has pale lilac fls. with a yellow center, tinted golden brown, striped with blue outside. Italy and Spain. G. 34:307. B.M. 265 (as *Ixia Bulbocodium*). There is another *R. Bulbocodium*, that of Kunze, which is the same as *R. Clusiæna*.—*R. Leichlinii*, Hort., has cream-white crocus fls. with a golden center.

F. TRACY HUBBARD.

RONDELÈTIA (named in memory of William Rondelet, 1507–66, a French physician and naturalist). Syn. *Rogiera*. *Rubiaceæ*. Evergreen shrubs and trees, a few of which are grown in the greenhouse or outdoors in the extreme southern United States.

Leaves opposite, rarely ternately whorled, sessile or petiolate, coriaceous or membranaceous: infl. corymbose or paniculate, axillary or rarely terminal cymes; fls. red, yellow or white; calyx-lobes equal; corolla-tube usually slender, swollen or not, throat glabrous or bearded; limb 5-lobed (in some species 4-lobed); ovary 2-celled: caps. loculicidal.—About 85 species, Trop. Amer. The whole family is noted as furnishing numerous desirable stove plants, and *Rondeletia* is a highly esteemed genus. The following species are shrubs growing 4 ft. or more high. The fls. are generally fragrant, and the clusters 4 in. or more across.

In the favorite species (*R. odorata*) the fls. number 10–30 in a cluster, each fl. being fully an inch across; in the other species the fls. may number 150–200 to a cluster, each fl. being less than $\frac{1}{2}$ in. across. *R. cordata* is often said to have a 4-lobed fl., a mistake that dates back more than half a century to a typographical error.

Rondeletias are of slow growth, and not many cultivators of plants care to give time and space to raise them; nevertheless some of the species, notably *R. odorata* var. *major*, deserve to be more widely grown. Cuttings from the half-ripened wood may be rooted at any time of the year. Spring, however, is considered the best time, as one has the season's growth ahead, and good plants may be had in the fall. Insert the cuttings in a 3-inch pot, in a mixture of finely sifted peat and sand and place them in a tight propagating-bed, in a temperature of 70°. Water them thoroughly and shade them from the sun. In a few weeks the cuttings will be rooted, when they may be potted in small pots, in the siftings of the root of the *osmunda* fern, with enough sand to keep it open. If a good fibrous peat can be procured, it answers the same purpose. A night temperature of 60° is best for these plants. Large plants, however, will winter safely at 50° to 55°. The advantage

of keeping small plants warmer is that they may be grown more quickly. As soon as the young plants have a good hold on their first pot, cut them back to two joints above the soil. Place them close to the glass and syringe two or three times a day. When the sun gets strong, shade them lightly in the middle of the day.

As soon as they are well rooted in their first pot, shift them into a size 2 inches larger, which will carry them



3427. *Rondeletia cordata*.
($\times \frac{1}{4}$)

through until the following spring. They would flower in this pot if allowed to do so, but it is advisable to keep them growing right along the first year. They may be cut back as soon as the shoots are long enough to leave two sets of leaves, after the heart has been taken out of them. As the plants grow larger, a third part of good fibrous loam may be added to the peat, and at all times they must be potted very firmly. After the plants have reached the size of an 8-inch pot, they may go two seasons without repotting, if they are fed with liquid manure as advised for *ixoras*. After color shows in the flowers, it is best to withhold manure until they have finished flowering, as the flowers will last much longer. After the flowers decay, if they are removed without cutting away much of the stem, they are liable to flower a second time the same year. It is preferable, however, to cut them well back, and if they require potting, do so, after they have broken into growth. When the young breaks have made four pairs of leaves, take out the heart of them. This treatment will double the number of shoots, and give a far better appearance when they come in flower. Mealy-bug will sometimes be found on *rondeletias*. They may be easily gotten rid of if the plants are removed to a house that is being fumigated with hydrocyanic gas. (George F. Stewart.)

A. *Fls. red.*

odorata, Jacq. (*R. speciosa*, Lodd.). Lvs. ovate, nearly sessile: clusters 10–30-fld.; fls. crimson to brick-red, with a conspicuous yellow throat; lobes elliptical to roundish. Cuba, Mex. B. 2:53. B.M. 3953. B.R. 1905. F.C. 1:36. L.B.C. 19:1893. P.M. 2:242; 16:354. R.H. 1891:522 (throat not conspicuously yellow). G.W. 6, p. 125. Var. *major*, Hort., is a form with larger fls.

AA. *Fls. pink to white.*B. *Base of lvs. more or less cordate.*

cordata, Benth. (*Rogièra cordata*, Planch. *R. thyrsiflora*, Hort., not Roth). Fig. 3427. Lvs. ovate, acuminate, cordate: generally said to have pink or flesh-colored fls. with a yellow throat (as in F.S. 8:754), but in R.H. 1878:230 they are shown as pure white. B.M. 8540. J.F. 2:122. Guatemala. Possibly also native in Mex.

latifolia, Hort. (*Rogièra latifolia*, Decne.). Lvs. large, heart-shaped, acuminate, short-petioled: fls. in corymbose cymes, the tubes pink, the limb white; calyx-lobes oval, obtuse. Guatemala. R.H. 1853:121.

BB. *Base of lvs. not cordate.*C. *Corolla-lobes ovate: stipules broadly ovate.*

amœna, Hemsl. (*Rogièra amœna*, Planch.). Lvs. elliptic, broader than in *R. gratissima*, and shorter, acuminate, 2–5 in. long: fls. rose-pink, with a conspicuous yellow throat. Guatemala. F.S. 5:442.—Intro. in Calif. See also *R. versicolor*, in suppl. list below

CC. *Corolla-lobes obcordate: stipules subulate.*

gratissima, Hemsl. (*Rogièra gratissima*, Lind.). Lvs. oblong-elliptic, 1–2 in. long, short-petioled, mostly rounded at the base: fls. with a bright rosy tube, the lobes fading from pale rose to whitish; throat not conspicuously yellow. Trop. Amer. I.H. 28:424. F.S. 15:1570 (corolla-lobes often obovate; stipules narrowly ovate). Gt. 490 (as *Rogièra elegantissima*). J.H. III. 52:365.

AAA. *Fls. blue. (Hindsia.)*

longiflora, Cham. (*Hindsia longiflora*, Benth.). Lvs. opposite, entire, lanceolate, more or less oval or sometimes almost linear, petiole very short, attenuate at the base: infl. terminal corymb; fls. blue; calyx-tube short, lobes linear; corolla-tube very long; segms. of lip oval, spreading and acuminate. R.H. 1858, p. 329. H.U. 4, p. 243.—This is now placed in the genus *Hindsia*, which differs from *Rondeletia* in general appearance and in the form of the corolla which is rather funnel-shaped than salver-shaped, without any callous contraction or beard at the mouth of the tube and by the caps. which is differently dehiscent. A second species of *Hindsia* is *H. violacea*, Benth., from Brazil. B.R. 30:40.

The following species have been occasionally cult.: *R. americana*, Linn. White-fld. W. Indies and S. Amer.—*R. anomala*, Hort., is an imperfectly known species said to have the lvs. in 3's, and coral-red or deep scarlet fls. with a presumably yellow throat. Habitat (?).—*R. Bäckhousii*, Hook., a pink-fld. species from Trop. Amer., is easily distinguished from those mentioned above by the much longer calyx-lobes, which are pink. B.M. 6290.—*R. Purdiei*, Hook., a beautiful pale yellow-fld. species from Colombia, has a great pyramidal cluster 5 in. across and 4 in. deep, with an astonishing number of fls., perhaps 150–200 in B.M. 5669.—*R. versicolor*, Hook. (*Rogièra versicolor*, Lindl. & Paxt.), is referred to *R. amœna* by Index Kewensis but seems distinct. The fls. are said to be "remarkable for their play of colors: the tube is yellow; the limb in bud deep rose-color, changing when they expand to pale rose and then to white, with a yellow disk, and having a 2-lobed green spot in the center from the color of the stamens, which protrude a little beyond the mouth." B.M. 4579. J.F. 2:112.

F. TRACY HUBBARD.†

ROOT-GALLS. Abnormal enlargements often appear on the roots of plants. These enlargements are much more frequent than is generally supposed, but from their position under ground are rarely observed. From an economic standpoint they have not received the attention that they merit.

Although the term root-gall is usually applied to the abnormal enlargement of roots due to insects and other animal organisms, it has a much wider application as used by most plant-growers. The presence of nodules or local enlargements on the roots of plants has been discussed by different authors under the names root-galls, root-knots, root-swellings, and the like. In cases in which the cause of the nodules of hypertrophied tissue is known, special names have been assigned to the enlargements. Thus the gall formed by the eel-worm (*Heterodera radiculicola*) is known as the nematode root-gall (Fig. 3428); the enlargement on the roots of cabbage and related plants by the myxomycete (*Plasmodiophora Brassicæ*) is called club-root; the swellings on the roots of the peach, apricot, and many other plants, which are of characteristic appearance and usually appear at the crown of the plant, are known as crown-gall. Root-tubercles are small gall-like bodies found on the roots of many leguminous plants. They are symbiotic in nature, the organism causing them being helpful to the plant. See *Legumes*.

Abnormal root enlargements are due to the following causes: (1) animal parasites, as in the nematode root-gall (Fig. 3428), the galls formed on the roots of



3428. Root-galls due to nematodes.—
Tomato roots.

the grape by the phylloxera, woolly aphid galls on apple tree roots, and the like; (2) vegetable parasites, as in the club-root and the crown-gall (Fig. 3429); (3) mechanical injury, causing excessive callous development, root-burls, and so on. In addition to these the causes of these enlargements are oftentimes obscure or unknown.

Swellings on the roots of the mulberry are said to be due

to the hypertrophy of the lenticels. Some investigators have attributed gall-like root-growths in some instances to the hypertrophy of adventitious buds.

The root-galls caused by the nematode (*Heterodera radiculicola*) may usually be readily recognized from other forms of hypertrophied tissue by the numerous knotty enlargements on the smaller roots infested by the worms. By careful search, in most instances, the distended female worms may be found in the infested tissue, where they appear as small nearly spherical pearl-like bodies, readily seen with the unaided eye. This minute worm, commonly called eel-worm, feeds upon the roots of a great variety of cultivated plants and is particularly destructive in the South. It is usually injurious in the northern states only to plants growing under glass. However, ginseng and some other outdoor perennials often suffer severely as far north as Michigan and southern Canada. The most effective remedy in the case of field crops is the removal of all rubbish that would harbor the worms during the winter. In green-houses steam can be forced through the infested soil. When potted plants are badly affected, they may be severely root-pruned and repotted in soil free from worms.

The root-swellings caused by the grape-vine gall-

louse (*Phylloxera vastatrix*) may be readily recognized from other root-galls by the presence of the insects. The young insects, by puncturing the epidermis of the roots and sucking the sap, cause the galls to develop. The insect is found on the diseased roots in all stages of development during the summer.



3429. A crown-gall.

The most effective method of holding the insect in check appears to be in the use of resistant roots, i. e., the grafting of the more tender varieties on roots of those that are stronger and better able to resist the attack of the insect. Bisulfide of carbon in some instances has proved effective in killing the lice.

The crown-gall appears to be the most harmful of root diseases affecting cultivated plants in this country. These galls have been reported upon the roots of the peach, apricot, almond, prune, plum, apple, pear, walnut, grape, raspberry, blackberry, cherry, poplar, and chestnut, and without doubt further investigation will find them on other plants as well. The crown-gall disease is now known to be due to a distinct species of pathogenic bacteria (*Bacterium tumefaciens*). It appears to be the same organism in all the host-plants affected by this disease. Seedlings from one to six months old appear to be most susceptible to this disease; hence it is particularly serious in the case of nursery stock. When the galls appear on young trees, they almost always occur on the side of the main root a few inches below the surface of the soil, or in the region of the crown. With more mature trees they are likely to occur at greater depth on lateral roots. At first the gall has a uniform outer appearance, but later it becomes warty from unequal growth. The tissue of the developing gall is soft and succulent, with nodules of woody tissue scattered through it. The galls vary much in size and may reach a diameter of 10 inches.

But little is known as to remedies for crown-gall. As the disease is primarily a nursery disease, the most effective remedy is in securing stock for planting from a non-infested nursery. This disease is often destructive to the roots of roses and asters in the greenhouse benches. Here the destruction of all diseased plants followed by steam sterilization of the soil is the only remedy.

J. W. TOUMEY.

H. H. WHETZEL.†

ROQUETTE, or ROCKET-SALAD (*Eruca sativa*, Mill.), a low-growing hardy annual from southern Europe, whose leaves resemble those of radish and turnip, is much used by the French as a spring and autumn salad and pot-herb. The flavor of the young, tender leaves, which are the parts used, bears a strong resemblance to that of horse-radish. In America it is but little grown because there are milder-flavored plants that serve the same purpose. See *Eruca*.

The first sowing may be made in early spring, the seed being dropped thinly in shallow drills a foot apart, with successional plantings each second or third week through the season. The soil must be rich and well supplied with moisture, else the leaves will probably be tough and acrid. Inter-culture is the same as for spinach, lettuce, and similar crops. Frequent watering and tillage in hot dry weather to insure rapid vigorous growth should result in succulent mild-flavored leaves. In summer the plants run rapidly to seed; in spring and autumn they will produce abundantly after being cut. The pale citron-yellow flowers emit a perfume resembling that of orange blossoms. M. G. KAINS.

RORIPA (etymology unexplained); originally spelled *Rorippa*, but later emended by its author. *Cruciferae*. Here are included the plants long known as *Nasturtium* (but not the garden flowers of that name, which belong in *Tropaeolum*), and by some later botanists as *Radicula* under which name they are described at page 2895. By a ruling of the International Botanical Congress at Brussels, however, the name *Radicula* is not permissible as it is based on a morphological character; therefore, the plants are transferred (at least temporarily) to *Roripa*. Under *Roripa*, the species become *R. Nasturtium*, Rusby (*Sisymbrium Nasturtium-aquaticum*, Linn. *Radicula Nasturtium-aquaticum*, Brit. & Rend.), the water-cress; *R. Armoracia*, Hitchc. (*Radicula Armoracia*, Rob.), the horse-radish; *R. indica*, Bailey (*Sisymbrium indicum*, Linn. *Nasturtium indicum*, DC.), the tropical cress.

L. H. B.

ROSÀ (ancient Latin name). *Rosaceæ*. *ROSÆ*. Ornamental shrubs chiefly grown for handsome flowers, also for ornamental fruits and attractive foliage.

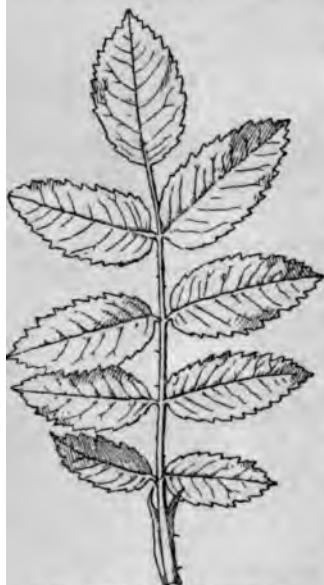
Deciduous or sometimes evergreen, upright, less often climbing or creeping shrubs with usually prickly sts.: lvs. alternate, odd-pinnate, rarely simple, stipulate (Figs. 3430, 3431): fls. solitary or corymbose at the end of usually short branchlets; petals and sepals 5, rarely 4; stamens numerous; pistils numerous, rarely few, inclosed in an urn-shaped receptacle, which becomes fleshy and berry-like at maturity, containing several or many bony achenes, usually erroneously called seeds; the fr. itself is called a "hip." (Figs. 3432, 3433.) *Rosa* is a widespread genus, easily distinguished by well-marked characters from allied genera, but in the limits of the genus itself the characters are exceedingly variable and it is very difficult to group into sections and species the innumerable forms which often pass gradu-



3430. A five-foliolate rose leaf.

ally into each other. In no other genus, perhaps, are the opinions of botanists so much at variance in regard to the number of species. While some, as Bentham and Hooker, estimate the number at about 30, the French botanist Gandoger actually describes from Eu. and W. Asia alone 4,266 species. The larger number of botanists recognize over 100 species. The roses

are almost equally distributed through the colder and temperate regions of the northern hemisphere, in Amer. extending to N. Mex., in Afr. to Abyssinia, and in Asia to India. The fls. show a remarkable tendency to become double, and such forms have been known and cult. from time immemorial. These innumerable garden forms, increasing every year, are almost exclusively of hybrid origin and are therefore omitted in the botanical classification of the genus.



3431. A nine-foliate rose leaf.

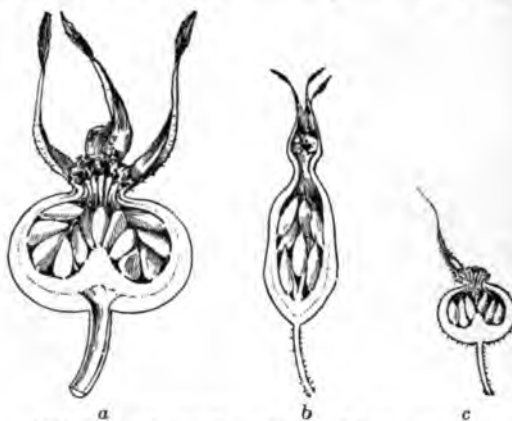
Many attempts have been made to subdivide the genus with more or less satisfactory results; the more important are those by A. DeCandolle, Lindley, Regel, and Baker. Nowadays the arrangement proposed by Crépín is considered the most natural and satisfactory and has been followed in the account given below. No good general monograph has been published since Lindley's "Monographia Rosarum" (1820), except a rather short one by Regel in 1877. Of the more recent publications the most important are those of Crépín, especially his "Primitiae Monographiae Rosarum." In consulting his publications one has to bear in mind that the author changed his opinion somewhat respecting the value of the species during his studies of the genus. In his later publications he takes a broader view in regard to the specific value of the rose forms and unites under one species many forms which he formerly considered as distinct species. An illustrated monograph valuable for the knowledge of the older garden forms and species is Thory and Redouté's "Les Roses," with 160 colored plates (1817-20). It is quoted below as Red. Ros. As the first edition in folio is found in only very few libraries, the smaller edition is cited in parenthesis by volume, groups and the sequence of the plates, neither pages nor plates being numbered continuously in this edition. The most recent book on roses is Miss Ellen Willmott's "The Genus Rosa," with about 150 excellent colored and numerous black plates; in this work all the important species of roses, including most of the recently introduced Chinese species and the types of our cultivated garden forms, are described and figured. It is quoted below as W. R. (with the number of the species).

The economic properties of the rose are of little importance. The most valuable product is attar of roses, a highly fragrant essential oil. It is chiefly manufactured in southeast Europe and western Asia from *Rosa alba* and *R. damascena*, and of late this industry has been successfully transplanted to Germany. See *Perfumery Gardening*, page 2547. The fruits of some species, especially of *R. villosa* and *R. canina*, are made into preserves.

The roses are mostly low or medium-sized shrubs, usually with prickly stems, often more or less stoloniferous, sometimes climbing or creeping, with small or medium-sized odd-pinnate deciduous or evergreen foliage and with mostly large and showy, solitary or clustered flowers ranging in color from purple, crimson, or pink to white and yellow, and followed by ornamental

usually scarlet or bright red fruits remaining on the branches a long time, sometimes through the whole winter. There is probably no flower more popular and better known than the rose. From time immemorial poets have sung its praise, and the love of it can be traced through the most ancient documents in the literature of the Aryan race. It is remarkable to note, however, that the rose has played a far inferior part in the horticulture of the Chinese and Japanese. It is probably the first flower known and cultivated in a double state, and it is the double-flowered garden form whose image the word "rose" almost invariably brings to the mind, while to the wild single-flowered roses much less attention has been given. The ornamental value of single roses is rarely fully appreciated. The wild roses have a simple charm and graceful beauty of their own. No doubt the bold and dominating beauty of the double roses has eclipsed the more modest attractions of the single roses. The longer blooming season of the garden roses is also a factor in their favor. Though the wild roses cannot, perhaps, be compared with their more noble sisters of the garden, they are nevertheless fully able to rival other ornamental shrubs for the adornment of park and plot. Most of the species are hardy or almost hardy North; among the hardiest are *R. rugosa*, *R. virginiana*, *R. carolina*, *R. acicularis*, *R. blanda*, *R. Woodsii*, *R. heliophila*, *R. palustris*, *R. rubrifolia*, *R. pendulina*, *R. canina*, *R. cinnamomea*, and *R. pomifera*. Hardy at least as far north as Massachusetts are *R. spinosissima*, *R. rubiginosa*, *R. multiflora*, *R. Helenz*, *R. arvensis*, *R. setigera*, *R. gallica*, *R. setipoda*, *R. omeiensis*, while others, as *R. Wichuraiana*, *R. sempervirens*, *R. sericea*, *R. fatida*, *R. hemisphaerica*, require some shelter or protection. Hardy only South are *R. Banksia*, *R. bracteata*, *R. chinensis*, *R. laevigata*, *R. odorata*, *R. stellata*. The recently introduced species from central and western China have not yet been sufficiently tested, but a large percentage appears to be hardy as far north as Massachusetts.

According to the habit peculiar to each species, they can be used for a variety of purposes. Most of the species are shrubby, rarely exceeding 6 or 8 feet, and may be used for borders of shrubberies or for covering slopes and rocky ridges, especially *R. rugosa*, *R. carolina*, and various American species. Some kinds,



3432. Various forms of rose hips. a, *Rosa rugosa*; b, *R. pendulina*; c, *R. carolina*. (About natural size.)

as *R. rugosa* and *R. virginiana*, make handsome ornamental hedges. The climbing species are used for covering walls, trelliswork, arbors, porches, or pillars, but perhaps display their beauty to the most advantage when allowed to ramble over shrubs or rocks. The half-evergreen *R. Wichuraiana* makes a beautiful ground-cover and may also be used for edging groups and flowerbeds. The fruits of most species are decorative and



3433. A spray of rose hips.

often remain on the branches all winter. The red stems of most of the species of the *Carolinæ* and *Cinnamomeæ* groups are effective in winter also. The foliage of most of the American species turns purple-orange or yellow in autumn, and so does that of *R. rugosa*, which is, in regard to the foliage with its dark green leathery and glossy leaves, the handsomest of the hardy roses.

With few exceptions the roses are of easy cultivation and grow in almost any kind of soil, except in a loose and very sandy one. They are readily transplanted. The wild roses need little pruning; they should only be thinned out and the weak and old wood be removed; long and vigorous shoots should not be shortened, especially in the climbing varieties, as these shoots are the most floriferous.

All true species can be propagated by seeds, but as roses are likely to hybridize, only seeds taken from isolated plants ought to be used. The hips should be gathered as soon as ripe, the seeds washed out and sown at once or stratified and sown in spring. They germinate the first year, but if kept in the hips during the winter and allowed to become dry, they usually do not germinate until the second year. Mice are very fond of the seeds. Almost all species grow readily from cuttings of nearly ripened wood in summer under glass. Many species, especially the climbing roses, can be propagated by hardwood cuttings taken in fall and planted in spring. Layering is less often practised, except with a few species, like *R. fetida* and *R. hemisphærica*, which do not grow readily from cuttings. Some species, especially those of the groups of *Cinnamomeæ*, *Carolinæ*, and *Gallicæ*, can be increased by root-cuttings; the roots are taken up in fall, stored during the winter in sphagnum or sand in a frost-proof room, and sown in spring in drills and covered about 2 inches deep. The species of the last-named groups and some others are also often increased by suckers and division. Budding and grafting is less often done with the wild roses and should be avoided for roses in shrubberies where the individual plants cannot be carefully watched; the stock usually throws up suckers and outgrows the cion, often in a short time. For general notes on culture and varieties, see *Rose*.

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KEY TO THE GROUPS.

(For a horticultural classification of roses, founded primarily on garden values, see the article *Rose*.)

Subgenus HULTHEMIA.

Lvs. simple, without stipules: fls. yellow.

Section 1. SIMPLICIFOLIÆ. Species No. 1

Subgenus EUROSA.

Lvs. pinnate stipulate.

A. Styles exerted beyond the mouth of the receptacle.

B. Exserted styles connate into a column, usually as long as stamens. (See Fig. 3434 right.)

Section 2. SYSTYLÆ. Species Nos. 2-10

BB. Exserted styles free, about half as long as stamens: fls. usually 5-5.

Section 3. INDICÆ. Species Nos. 11-14

AA. Styles reaching only the mouth of the receptacle and stigmas forming a sessile head over it (see Fig. 3434), but slightly exserted in Nos. 53 and 54.

B. Stipules free or adnate only at the base, small: sarmentose or climbing shrubs: fls. white or yellow.

- c. Branches glabrous: lfts. 3-5, stipules entire or denticulate.
- d. Fls. small, umbellate, yellow or white: pedicels and receptacle smooth: stipules subulate, caducous.
- Section 4. *BANKSIANÆ*. Species Nos. 15, 16
- DD. Fls. large, solitary, white: pedicels and receptacle bristly: stipules denticulate.
- Section 14. *LÆVIGATÆ*. Species No. 59
- CC. Branches tomentose or pubescent: lfts. 7-9; stipules pectinate: fls. 1 or few, white, with large bracts at the base of the short pedicel: receptacle tomentose.
- Section 13. *BRACTEATÆ*. Species No. 58
- BB. Stipules adnate more than one-half of their length.
- c. Receptacle smooth or hispid.
- D. Lvs. of flowering branchlets 3-5-foliolate, large and firm: sts. usually with prickles and bristles: fls. upright, on long pedicels: receptacle bristly; sepals usually pinnate, reflexed after flowering, caducous.
- Section 5. *GALLICÆ*. Species Nos. 17-21
- DD. Lvs. of flowering branchlets 5-11-foliolate (rarely 3-foliolate, the fls. then short-pedicelled, with smooth receptacle).
- E. Fls. usually corymbose: if solitary, pedicels with 1 or more bracts.
- F. Sts. with only one kind of prickles, sometimes mixed with glandular bristles: prickles usually hooked, stout, scattered: outer sepals usually pinnate.
- Section 6. *CANINÆ*. Species Nos. 22-27
- FF. Sts., at least at the base, with usually straight often slender prickles and numerous bristles gradually passing into prickles.
- G. Sepals after flowering spreading, usually entire, caducous: infl. usually glandular-hispid: fr. usually hispid, with the achenes only at the bottom. (See Fig. 3432, c)
- Section 7. *CAROLINÆ*. Species Nos. 28-32
- GG. Sepals after flowering upright, usually entire, rarely caducous: fr. usually smooth, with the achenes at the bottom and wall. (See Fig. 3432, a, b.)
- Section 8. *CINNAMOMÆ*. Species Nos. 33-48
- EE. Fls. solitary, without bracts, only occasionally corymbose; sepals erect, persistent: lfts. small.
- F. Petals 5; styles not exerted.
- G. Lfts. usually 9 on the flowering branchlets: prickles straight, usually mixed with bristles and slender: fls. white, pink or yellow; sepals entire.
- Section 9. *PIMPINELLIFOLIÆ*. Species Nos. 49, 50
- GG. Lfts. 5-7 on the flowering branchlets: prickles usually hooked, rather stout: fls. yellow; sepals pinnate, rarely entire.
- Section 10. *LUTEÆ*. Species Nos. 51, 52
- FF. Petals 4, only occasionally 5, white; styles somewhat exerted: lfts. 7-17.
- Section 11. *SERICÆ*. Species Nos. 53, 54
- CC. Receptacle prickly.
- D. Lvs. on flowering branchlets 3-7-foliolate; lfts. cuneate-obovate, incisely dentate.
- Section 12. *MINUTIFOLIÆ*. Species Nos. 55-57
- DD. Lvs. of flowering branchlets 7-15-foliolate; lfts. elliptic or elliptic-oblong, sharply serrate.
- Section 15. *MICROPHYLLÆ*. Species No. 60

SUMMARY OF SECTIONS.

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Subgenus HULTHEMIA.

Section 1. *SIMPLICIFOLIÆ*. Only one Asiatic species, distinguished from all other roses by the simple exstipulate lvs.

1. *pérsica*, Michx. (*R. simplicifolia*, Salisb. *R. berberifolia*, Pall. *Lôwea berberifolia*, Lindl.). Low straggling shrub, 2 ft. high, with slender, prickly branches: lvs. short-petioled, oval to oblong, acute at both ends, serrate, bluish green, pubescent, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: fls. solitary, yellow, with red eye, about 1 in. across: fr. prickly. June. N. Persia to Siberia. B.M. 7096. B.R. 1261. G.C. III. 6:8, 9, 78. W.R. 1.—This



3434. Section of rose flowers. To show two forms of styles. ($\times \frac{1}{2}$)

peculiar rose is very rare in cult., since it is very difficult to grow. It has been successfully cult. in a cool greenhouse, exposed to the full sun, kept moist during summer and dry from October to March. The only way to prop. it seems to be by suckers; seeds are occasionally intro. from its native country. A hybrid of this species with *R. involucrata* is *R. Hårdii*, Cels., with 5-7-foliolate lvs. and large yellowish white fls., with a deep orange eye. G.C. II. 24:469. Gn. 19, p. 473. P.M. 10:195. W.R. 2.

Subgenus EUROSA.

Section 2. *SYSTYLÆ*. A group of about 12 species (one of them American), well marked by the styles being connate into a slender exerted column. Sts. sarmentose or climbing, with hooked prickles: fls. in corymbs, few or many; outer sepals pinnate, rarely entire, reflexed after flowering, caducous.

- A. Stipules pectinate: prickles usually in pairs..... 2. *multiflora*
- AA. Stipules entire or denticulate: prickles scattered.
- B. Habit more or less upright with usually arching branches.
- C. Lvs. of flowering branchlets 3-5-foliolate, pubescent beneath.
- D. Fls. small, $\frac{1}{2}$ in. across: lfts. linear-lanceolate..... 3. *Watsoniana*
- DD. Fls. 2 in. across: lfts. generally ovate-oblong..... 4. *setigera*
- CC. Lvs. of flowering branchlets 5-9-foliolate.
- D. Lfts. usually 5-7: corymb paniculate: fr. less than $\frac{1}{2}$ in. long, subglobose.
- E. Under side of lfts. pubescent: prickles hooked..... 5. *Brunonii*
- EE. Under side of lfts. glabrous or a few hairs on the midrib: prickles straight or nearly so..... 6. *moschata*
- DD. Lfts. usually 7-9: corymb umbellate: fr. more than $\frac{1}{2}$ in. long, ovoid..... 7. *Helensæ*

BB. *Habit creeping, or prostrate.*C. *Foliage half-evergreen, lustrous; fls. usually several.*D. *Fls. usually 9, obtuse, $\frac{1}{4}$ – $\frac{1}{2}$ in. long.*DD. *Fls. usually 5, acuminate, $\frac{3}{4}$ –2 in. long.*CC. *Foliage deciduous, dull; fls. usually 7; fls. more often solitary.*8. *Wichuriana*9. *sempervirens*10. *arvensis*

2. *multiflora*, Thunb. (*R. polyanthos*, Roessig. *R. thyrsoflora*, Leroy. *R. intermedia*, Carr. *R. Wichurae*, Koch). Fig. 3435. Deciduous shrub, with vigorous, long, recurving or climbing branches: lfts. usually 9, obovate to oblong, acute or obtuse, serrate, pubescent, $\frac{3}{4}$ –1 $\frac{1}{2}$ in. long: fls. in many-fl. pyramidal corymbs, usually white, $\frac{3}{4}$ in. across or more; sepals ovate, abruptly acuminate; styles glabrous: fr. small, globular. June. Japan, China. B.M. 7119. G.F. 3:405 (adapted in Fig. 3435); 4:535; 6:316, 317. A.G. 18:677. A.F. 6:1003. Gn. 49, p. 368 (as *R. microcarpa*); 55, p. 432; 66, p. 25. G.M. 44:425 (as *R. polyantha simplex*). R.H. 1902, p. 205. G.W. 7, p. 148; 13, pp. 342, 343. Gng. 5:120, 121.—The typical form which is sometimes distinguished as var. *Thunbergiana*, Thory, has small single white fls. and is found in Japan and Korea. Var. *cathayensis*, Rehd. & Wilson. Fls. pink, about 1 $\frac{1}{2}$ in. across, in rather flat corymbs. China. This is the wild single-fl. form from which the two following varieties have been derived. Var. *carnea*, Thory (var. *plena*, Regel. *R. florida*, Poir.). With double light pink fls. B.M. 1059. B.R. 425. Var. *platyphylla*, Thory, with larger lvs. and larger double, deep pink fls. B.R. 1372. This is known as SEVEN SISTERS ROSE. A form of this with intense red and more numerous fls. is the well-known "Crimson Rambler," one of the best climbing roses (Fig. 3436). A.G. 16:233. Many hybrids have originated in cult.; they usually show their parentage by the pectinate stipules. A hybrid with *R. rugosa* is *R. ludra*, Sieb., with single, rather small white fls. W. R. 61. Of the same parentage is *R. yedoensis*, Makino, with small pink fls. *R. polyantha*, Hort., not Roessig, is a trade name for hybrids with *R. chinensis*. Gn. 29:118. G.C. III. 29:135. G. 27:347. J.H. III. 43:425. The Dawson rose, or *R. Dawsoniana*, is a hybrid with General Jacqueminot. G.W. 7, p. 125. Hybrids with *R. setigera*, *R. gallica*, and *R. Wichuriana* have also been raised.

3435. *Rosa multiflora*. ($\times \frac{1}{2}$)

3. *Watsoniana*, Crépin (*R. multiflora* var. *Watsoniana*, Matsum.). Fig. 3437. Deciduous shrub, with sarmentose or recurving branches: lfts. 3–5, linear-lanceolate, with entire wavy margin, pubescent beneath, 1–2 $\frac{1}{2}$ in. long: fls. in many-fl. pyramidal corymbs, $\frac{1}{2}$ in. across or less, white or pink; style glabrous: fr. small.



3436. Crimson Rambler rose. (See No. 2.)

June, July. R.B. 14, p. 183. G.F. 3:477 (adapted in Fig. 3437). W.R. 16.—A very curious rose of unknown origin, supposed to have been intro. from Japan, but not known in a wild state. Not quite hardy North.

4. *setigera*, Michx. PRAIRIE ROSE. Figs. 3438, 3439. Shrub with prickly branches attaining 6 ft., with long and slender recurving or climbing branches: lfts. 3–5, ovate to oblong-ovate, shortly acuminate, serrate, tomentose beneath, 1–3 in. long: fls. in rather few-fl. corymbs, deep rose, fading to whitish, about 2 in. across, almost scentless; pedicels and receptacle glandular-hispid; style glabrous: fr. globular, $\frac{1}{2}$ in. across. June, July. From Ont. and Wis. to Texas and Fla. Mn. 8:65. G.F. 10:323 (adapted in Fig. 3438). A.G. 13:196, 197; 16:229. Gng. 1:325. C.L.A. 4:339; 7:473. G.W. 7, p. 149. W.R. 23. M.D.G. 1900:423. Var. *tomentosa*, Gray (*R. rubifolia*, R. Br.). Lvs. more tomentose beneath: corymbs with more, but smaller fls.—A valuable hardy climbing rose. Several varieties with double fls. are in cult.; some are probably hybrids with *R. arvensis*, *R. multiflora*, *R. Noisettiana*, and other species.

5. *Brunonii*, Lindl. (*R. Brownii*, Tratt. *R. moschata* var. *nepalensis*, Lindl.). HIMALAYAN MUSK ROSE. Tall shrub, with arching or sarmentose branches, glabrous or thinly villous while young; prickles scattered, hooked, short and stout: lfts. 5–7, elliptic-oblong to oblong-lanceolate, acute or acuminate, serrulate, soft-pubescent beneath, slightly pubescent or nearly glabrous above, 1 $\frac{1}{2}$ –2 $\frac{1}{2}$ in. long; petioles and rachis pubescent, usually with scattered prickles: fls. white, fragrant, 1 $\frac{1}{2}$ –2 in. across, in large many-fl. corymbs; sepals lanceolate, lobed, much longer than receptacle; pedicels long and slender, pubescent and glandular; styles pubescent: fr. ovate, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, glabrous; sepals deciduous. June, July. Himalayas, W. China. B.M. 4030. B.R. 829. F.S. 4:366, 367. Gn. 73, p.

493; 77, p. 511; 79, p. 113 (as *R. moschata*). G. 6:529; 30:419. G.C. III. 36:152, 153. W.R. 10.—A handsome strong-growing rose, but more tender than the real musk rose with which it has been much confused.

6. *moschata*, Mill. (*R. ruscinonensis*, Desv.). MUSK ROSE. Shrub, with arching or sarmentose branches,



3437. *Rosa Watsoniana* ($\times \frac{1}{2}$). No. 3.

glabrous; prickles rather small and slender, straight or slightly hooked: lfts. 5-7, elliptic-ovate to oblong-ovate, acute or acuminate serrulate, glabrous above, hairy on the midrib beneath, otherwise glabrous or nearly so, 1-2 in. long; petioles and rachis nearly glabrous, usually prickly: fls. white, $1\frac{1}{2}$ -2 in. across, fragrant with the odor of musk, in usually 7-fl. corymbs; sepals lanceolate, much longer than the receptacle, lobed, deciduous; pedicels slender, slightly pubescent and glandular; styles pubescent: fr. ovate, small, June, July. S. Eu., N. Afr. W.R. 9. Var. *nastarana*, Christ (*R. Pissardii*, Carr.). A more robust form: prickles slightly curved: lfts. nearly glabrous beneath: fls. more numerous, over 2 in. across. Persia. R.H. 1880, pp. 314, 315. W.R. 10. Hardier than the type. Var. *abyssinica*, Rehd. (*R. abyssinica*, Lindl.). More prickly and glandular: lfts. smaller, scarcely acuminate: infl. more compact; sepals with smaller lobes or without. Abyssinia. Tender; cult. in Calif.—The musk rose of the older writers, known since the 16th century, seems to have at present almost disappeared from cult.; the plant generally cult. under this name is *R. Brunonii*, which is superior as a garden plant, though it is somewhat tenderer. Several hybrids are known; the most important is *R. Noisettiana*, a hybrid with *R. chinensis* (see No. 13). A hybrid with *R. gallica* is *R. Dupontii*, Déségl. (*R. moschata* var. *nivea*, Lindl.), which differs chiefly in its broader and fewer lfts., the glandular pedicels, the larger fls. with shorter styles and in the presence of bristles on the st. B.R. 861. Gn. 67:254; 77, p. 510. W.R. 13.—*R. moschata densa*, Vilm., belongs probably to *R. Gentiliana* (see suppl. list).

7. *Hélenæ*, Rehd. & Wilson. Sarmentose shrub, to 15 ft.: branches with stout hooked prickles: lfts. usually 7-9, rarely less, oblong-ovate or ovate-lanceolate, short-acuminate, rounded or cuneate at the base, sharply serrate, glabrous above, grayish green beneath and

hairy on the veins, 1-2 in. long: fls. white, fragrant, $1\frac{1}{2}$ in. across, in many-fl. umbel-like corymbs 3-6 in. broad; pedicels slender, about 1 in. long, like the receptacles stipitate-glandular, sepals lanceolate, sparsely pinnate; styles hairy: fr. ovoid or oblong-obovoid, scarlet, about $\frac{1}{2}$ in. long, with deciduous sepals. June. Cent. China.—A handsome free-flowering rose with large clusters of fragrant white fls. in June and scarlet frs. in autumn; has proved hardy at the Arnold Arboretum.

8. *Wichuraiana*, Crépin (*R. Lucie* var. *Wichuraiana*, Koidzumi. *R. bracteata*, Hort., not Wendl.). MEMORIAL ROSE. Fig. 3440. Half-evergreen shrub with prostrate and creeping branches: lfts. roundish or broadly obovate, usually obtuse, serrate, glabrous, shining above, $\frac{1}{8}$ - $\frac{3}{4}$ in. long; corymbs few-fl. or many-fl., pyramidal; fls. white, fragrant, $1\frac{1}{4}$ -2 in. across; styles pubescent; pedicels slightly glandular-hispid: fr. ovoid, to $\frac{1}{2}$ in. high. July-Sept. Japan. B.M. 7421 (as *R. Lucie*). G.F. 4:569 (adapted in Fig. 3440); 6:337. C.L.A. 7:621. G.M. 45:214. Gn. 62, p. 7; 73, p. 164. G.C. III. 22:99. R.H. 1898:105, 106. M.D.G. 1898:580-5.—A handsome rose for covering banks and rockeries. A number of hybrids, especially with Hybrid Tea roses, have been raised. G.F. 6:337. Mn. 8, pp. 27 and 156. Gng. 6:353-5. Var. *rubra*, André, with single carmine fls., $1\frac{1}{2}$ -2 in. across, and the lvs. with 5-7 somewhat larger lfts., is a hybrid of *R. Wichuraiana* and *R. multiflora* var. *Crimson Rambler*. R.H. 1901:20. A hybrid with *R. rugosa* is *R. Jacksonii*, Willmott, with bright crimson fls., extremely floriferous and of graceful habit. W.R. 20.

9. *sempervirens*, Linn. Evergreen shrub with long and slender, sarmentose, somewhat reddish branches: lfts. 5-7, ovate-lanceolate, acuminate, serrulate, glabrous, shining above, $\frac{3}{4}$ -2 in. long: fls. in few-fl., rarely many-fl. corymbs, white, to 2 in. across, slightly fragrant; pedicels glandular-hispid; styles usually pubescent: fr. subglobose or ovoid, orange-red. June,



3438. *Rosa setigera* ($\times \frac{1}{2}$). No. 4.

July. S. Eu., N. Afr. B.R. 465. W.R. 5. Var. *prostrata*, Nichols. (*R. prostrata*, Lindl.). Lfts. smaller, oval, acute: fr. ovoid. Var. *scandens*, Nichols. (*R. scandens*, Mill.). Lfts. oblong or oval, obtuse: fr. subglobose. There are some double-fl. garden forms, probably hybrids with *R. chinensis* and other roses. Less hardy than the following.

10. *arvensis*, Huds. (*R. repens*, Scop. *R. silvestris*, Herrm.). Deciduous shrub, with sarmentose or creeping sts.: lfts. usually 7, ovate to ovate-elliptic, acute, serrate, dull above, glabrous or slightly pubescent beneath, rather thin, $\frac{1}{2}$ –1½ in. long: fls. in few-fl. corymbs, sometimes solitary, white, scentless, 1½–2 in. across; style glabrous: fr. ovoid. June, July. Eu. B.M. 2054. Gn. 60, p. 233; 77, p. 510. W.R. 3.—A hybrid with *R. chinensis* is *R. ruga*, Lindl., a trailing shrub with large, fragrant double pink fls. in several-fl. corymbs: lfts. ovate, glabrous. B.R. 1389. W.R. 17. Another hybrid is *R. Poliniadna*, Spreng. (*R. arvensis* × *R. gallica*). Upright or sarmentose: lfts. usually 5, large, of firmer texture: fls. long-stalked, large, white to purple. W.R. 111. Here belongs probably the AYRSHIRE ROSE (*R. arvensis* var. *capreolata*, Neill.), with double white to deep pink fls. G.W. 1, p. 355.

Section 3. INDICÆ. Few Asiatic species with upright or procumbent sts.: prickles scattered, hooked, few: lfts. 3–5 rarely 7: inf. 1- to many-fl.; sepals entire or the outer ones sparingly pinnate, reflexed after flowering; bracts and stipules narrow, the latter with small, divergent auricles.

- A. Sts. with uniform prickles: lvs. glabrous.
- B. Lvs. persistent or subsistent.
- C. Fls. white, yellowish or light pink, very fragrant: fr. globose or depressed-globose; sepals usually entire: stipules without or with few marginal glands at the auricles 11. *odorata*
- CC. Fls. red or pink, rarely whitish, not or slightly fragrant: fr. ovoid or pyriform; sepals usually pinnate: stipules glandular-ciliate 12. *chinensis*
- BB. Lvs. deciduous: fls. many in a corymb 13. *Noisettiana*
- AA. Sts. with prickles and bristles: lvs. slightly pubescent beneath: fls. solitary or few 14. *borbonica*

11. *odorata*, Sweet (*R. indica* var. *odoratissima*, Lindl. *R. Thèa*, Savi. *R. chinensis* var. *fragrans*,



3439. Baltimore Belle rose.—*Rosa setigera* (×½). No. 4.

Rehd.). TEA ROSE. Shrub with long sarmentose often climbing branches armed with scattered hooked prickles: lvs. evergreen or half-evergreen; lfts. 5–7, elliptic or ovate to oblong-ovate, acute or acuminate, sharply serrate, lustrous above, glabrous, 1–3 in. long; stipules glandular-ciliate usually only above the middle,



3440. *Rosa Wichuraiana* (×½). No. 8.

often sparingly: fls. solitary or 2–3, on rather short, often glandular stalks, white, light pink or salmon. pink, or yellowish, 2–3½ in. across; sepals entire: fr. globose or depressed-globose, red. W. China. Red. Ros. 1:19 (3:25, 19). B.R. 804.—The original TEA ROSE with double blush fls. was intro. into England in 1810 and in 1824 the form with pale yellow double fls., var. *ochroleuca*, Rehd. (*R. indica* var. *ochroleuca*, Lindl.). Red. Ros. (3:25, 20). From the crossing of the forms of this species between themselves and also with *R. chinensis* the Tea roses of our gardens have originated, while the Hybrid Teas are the offspring of crosses between the Tea roses and other garden roses. Var. *pseud-indica*, Rehd. (*R. chinensis* var. *pseud-indica*, Willmott. *R. Fortuniana*, Paxt., not Lindl.). FORTUNE'S DOUBLE YELLOW. BEAUTY OF GLAZENWOOD. GOLD OF OPHIR. Branches sarmentose, with strongly hooked prickles: lfts. 5–7, elliptic-oblong, firm: fls. 3–4, double, salmon-yellow, sweet-scented, outside tinged with red. B.M. 4679. F.S. 8:769. W.R. 28. Var. *erubescens*, Rehd. & Wilson, has single blush or pale pink fls. and is probably like the following one of the wild forms of the double-fl. garden varieties. *R. chinensis* var. *grandiflora*, Willmott (W.R. 29) is scarcely different. Var. *gigantea*, Rehd. & Wilson (*R. gigantea*, Collett & Hemsl.). Fls. creamy white, single, 4–6 in. across; pedicels and receptacles smooth. Very vigorous, climbing to 50 ft. S. W. China, Burma. G.C. III. 6:13; 37:136; 51:314. Gn. 67, p. 179; 71, p. 67. B.M. 7972. W.R. 34. To this variety *R. macrocarpa*, Watt (*R. xanthocarpa*, Watt) from Manipur, has been referred as a synonym, but the author maintains that it is a distinct species and that it has yellow fls. and edible yellow frs. as large as a small apple.—*R. odorata gigantea* is hardy only S. and is cult. in Calif., where it blooms from Nov. to May. Hybrids with *R. moschata* have been raised by Franceschi at Santa Barbara, Calif.; these are Madeleine Lemoine, Montarioso, and Montecito and they combine the vigor and the foliage of var. *gigantea* with the paniculate infl. of *R. moschata*. Other hybrids with different garden roses have been raised in Eu.

12. *chinensis*, Jacq. (*R. indica*, Lindl., not Linn. *R. chinensis* var. *indica*, Koehne. *R. indica* var. *vulgaris*,

Lindl.). CHINA ROSE. BENGAL ROSE. Low upright shrub with slender branches usually armed with scattered stout compressed more or less hooked prickles, sometimes almost unarmed: lfts. 3-5, broadly ovate to ovate-oblong, acuminate, serrate, shining and dark green above and pale beneath, glabrous, 1-2½ in. long; stipules narrow, glandular-ciliate: fls. usually several, less often solitary, on long usually glandular stalks, rarely short-stalked, crimson or pink, rarely whitish, about 2 in. across, not or slightly fragrant; outer sepals usually pinnate: fr. obovoid or turbinate, about ¾ in. long. China. W.R. 26. The wild form recently discovered in Cent. China is var. *spontanea*, Rehd. & Wilson, with single deep red or pink, usually solitary fls. G.C. III. 31:438. The following varieties are garden forms.

Var. *semperflorens*, Koehne (*R. semperflorens*, Curt. *R. bengalensis*, Pers.). CRIMSON CHINESE ROSE. Low shrub, with slender, prickly or almost unarmed, dark green branches: lfts. rather thin, mostly stained with purple: fls. usually solitary on slender pedicels, crimson, or deep pink. B.M. 284. W.R. 30.

Var. *longifolia*, Rehd. (*R. longifolia*, Willd.). Lfts. lanceolate: fls. single, deep pink. Red. Ros. (3:25, 8).

Var. *minima*, Rehd. (*R. Laurenciana*, Hort. *R. indica* var. *pumila*, Thory). Dwarf shrub, usually not over 1 ft. high, with small rose-red fls. about 1½ in. across; petals often pointed. There are single- and double-fl. forms. The FAIRY ROSES belong to this variety. B.M. 1762. Red. Ros. (3:25, 6, 7).

Var. *viridiflora*, Dipp. GREEN ROSE. With monstrose green fls.; the petals are transformed into small, narrow green lvs. F.S. 11:1136.

Var. *Manetti*, Dipp. (*R. Manetti*, Hort.). Fig. 3441. Of vigorous growth, upright; pedicels hispid-glandular: fls. deep pink, single or semi-double. This variety has been recommended as a stock for forcing roses; grows readily from cuttings, but is not quite hardy.



3441. The Manetti rose. Much used as a stock (x ½).
See No. 12.

13. *Noisettiana*, Thory. NOISSETTE ROSE. CHAMPNEY ROSE. Supposed hybrid of *R. chinensis* and *R. moschata*. Sts. upright to 6 ft., with hooked uniform reddish prickles: lfts. 5-7, usually oblong-lanceolate or oblong-ovate, glabrous: fls. usually many in corymbs, white to pink or red, sometimes yellow; styles pubescent, loosely cohering, protruding beyond the disk. Blooms in summer and fall. Gn. 71, p. 335. W.R. 32. —Numerous garden forms. The Noisette rose was raised about 1816 by John Champney, of Charleston, S. C., from seed of the musk rose fertilized by a blush China rose. From the seed of this hybrid Philippe Noisette,

a florist at Charleston, obtained a rose which was afterward distributed as Blush Noisette by his brother Louis Noisette, of Paris.

14. *borbónica*, Morr. BOURBON ROSE. Supposed hybrid of *R. chinensis* and *R. gallica*. Upright shrub, with prickly and often glandular-hispid branches: lfts. usually 7, ovate or ovate-lanceolate, acute, shining, slightly pubescent beneath: fls. 1 or few in a corymb, on glandular pedicels, double or semi-double, usually purple, blooming in summer and fall. W.R. 114. Originated from a rose intro. about 1819 from the Island of Bourbon where it was found among seedlings of the Bengal rose by Mr. Périchon and sent by Mr. Bréon, director of the botanic garden at Bourbon, to Jacques, gardener to the Duke of Orléans at Neuilly near Paris; this rose, called Rose Edward, by crossing with roses of the Gallica groups has given rise to the Hybrid Bourbon roses and is the origin together with crosses between this and other hybrids of *R. chinensis* and its varieties and *R. damascena* of the Hybrid Perpetual or Remontant class.

Section 4. BANKSIANÆ. Contains one Chinese species with climbing, sparingly prickly or unarmed sts.: stipules quite free, subulate, caducous: sepals entire, reflexed after flowering, caducous.

A. Pedicels glabrous; fls. small 15. *Banksia*
AA. Pedicels hispid; fls. large 16. *Fortuneana*

15. *Banksia*, R. Br. BANKS' ROSE. Climbing to 20 ft., evergreen: lfts. 3-5, sometimes 7, elliptic-ovate to oblong-lanceolate, acute or obtusish, finely serrate, shining, glabrous except at the base of midrib beneath: fls. on slender, smooth pedicels in many-fl. umbels, white or yellow, about 1 in. across, slightly fragrant. May, June. Cent. and W. China. G.C. III. 31:439. J.H.S. 27:501. Var. *albo-plena*, Rehd., with double white fls. B.M. 1954. Var. *lutea*, Lindl. (var. *luteo-plena*, Rehd.), with double yellow fls. B.R. 1105. Var. *lutescens*, Voss, with single yellow fls. B.M. 7171. Var. *normalis*, Regel, with single white fls. is the wild form.—Intro. first into Eu. by Wm. Kerr, in 1807 in the double white form; the double yellow form was intro. about 1825, while the single white and yellow forms were not known until 40 or 50 years later. Not hardy N.; sometimes grown in greenhouses.

16. *Fortuneana*, Lindl., supposed to be a hybrid of *R. Banksia* and *R. laevigata*. Climbing shrub, with sparingly prickly sts.: lfts. 3-5, ovate-lanceolate, lustrous: fls. solitary, large, double, white, on hispid pedicels. F.S. 7, p. 256. J.F. 2, p. 27. W.R. 36.

Section 5. GALLICÆ. Contains only one very variable species, native of Eu. and W. Asia. Low, upright shrub: the sts. with usually hooked prickles mixed with bristles: fls. few and often with narrow bracts or solitary on a usually bractless pedicel; sepals reflexed after flowering, caducous, the outer ones pinnate; upper stipules not dilated.

A. Prickles very unequal: lfts. usually doubly and glandular-serrate.
B. Texture of lfts. firm, leathery: pedicels upright 17. *gallica*
BB. Texture of lfts. thin; lfts. sometimes simply serrate: fls. nodding, usually double 18. *centifolia*
AA. Prickles uniform: lfts. simply serrate, not glandular. (Supposed hybrids of *R. gallica*.)
B. Prickles numerous.
C. Receptacle glandular-hispid: lfts. ovate-oblong, often pubescent beneath 19. *damascena*
CC. Receptacle usually smooth: lfts. broadly ovate or broadly elliptic, pubescent beneath 20. *alba*
BB. Prickles sparse, on the flowering branchlets nearly wanting: lfts. glabrous beneath or pubescent only on the midrib 21. *francofurtana*

17. *gallica*, Linn. Upright shrub, with creeping rootstock, rarely attaining 5 ft. high: sts. usually densely covered with prickles and bristles: lfts. 3-5, leathery, broadly oval or ovate, rounded at base, usually doubly serrate with glandular teeth, rugose above, pubescent beneath, deflexed, 1-2 in. long; rachis glandular-pubescent and often prickly: fls. on rather stout, upright,



3442. *Rosa centifolia* var. *muscosa*.—Moss rose. ($\times \frac{1}{2}$)

glandular-hispid and bristly pedicels, deep pink to crimson, 2-3 in. across; receptacle glandular-hispid: fr. subglobose or turbinate, brick-red. June. Cent. and S. Eu., W. Asia. G.W.H. 1:89.—The following are the most important forms: Var. *Agatha*, Thory. With rather small, very double purple fls., the outer petals spreading, the inner ones concave. Red. Ros. (2:17, 17-21). Var. *incarnata*, Rehd. (*R. incarnata*, Boreau, not Mill.). Lfts. narrower, elliptic-ovate to elliptic-oblong: rachis not prickly; flowering branches unarmed: fls. large, pale crimson, solitary: fr. ovoid. B.M. 7035. Var. *macrantha*, Hort., similar to the preceding, but fls. pale pink, finally white. Gn. 52:464. G. 29:417. R.H. 1901:548. Var. *officinalis*, Thory (*R. provincialis*, Mill. Var. *plena*, Regel), is like the typical form but with double fls. W.R. 121.

Var. *versicolor*, Thory. ROSA MUNDI; also YORK AND LANCASTER ROSE. Petals striped white and red. W.R. 110. Red. Ros. (2:16, 12). Var. *phimila*, Braun (*R. austriaca*, Crantz). Dwarf form, with creeping rootstock: fls. red, single. Red. Ros. (2:17, 2).

18. *centifolia*, Linn. (*R. gallica* var. *centifolia*, Regel). CABBAGE ROSE. Closely allied to the preceding species. Rootstock less creeping: prickles stouter: lfts. usually 5, pubescent on both sides or only beneath, larger and thinner; rachis not prickly: fls. usually pink, very double, on long and slender pedicels, nodding, fragrant; petals inflexed; sepals persistent. June, July. E. Caucasus. W.R. 115. G. 1:340. Of this rose the double-flowered form only is in cult., known already to the ancients. Var. *muscosa*, Sér. (*R. muscosa*, Ait.). Moss Rose. Fig. 3442. Fls. rose, with peduncles and calyx glandular-mossy. B.M. 69. Gn. 18:84. G.W. 7, p. 125. Var. *albo-muscosa*, Willmott. Like the preceding, but fls. white. B.R. 102. W.R. 117. Var. *cristata*, Prévost, has the mossy excrescences confined to the edges of the sepals. B.M. 3475. G.W. 7,

p. 125. W.R. 118. Var. *pompônia*, Lindl. (*R. pulchella*, Willd. *R. dijontensis*, Roessig). POMPON ROSE. Dwarf form: lfts. elliptic, glabrous above, about 1 in. long: fls. double, bright red, $1\frac{1}{2}$ in. across; pedicels densely setose. W.R. 119. Var. *parvifolia*, Rehd. (*R. parvifolia*, Ehrh. *R. burgundica*, Roessig). BURGUNDIAN ROSE. Similar to the preceding, but smaller: lfts. $\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. about 1 in. across; pedicels slightly setose. B.R. 452. W.R. 120.—Numerous spontaneous hybrids are known. From this with its varieties, and *R. damascena*, the Hybrid Perpetual or Remontant roses have originated by hybridizing with *R. chinensis* and its forms.

19. *damascena*, Mill. (*R. biferâ*, Pers. *R. calendârum*, Borkh.). DAMASK ROSE. Attaining 5 ft.: sts. usually with numerous stout and hooked prickles, sometimes mixed with glandular bristles: lfts. usually 5, sometimes 7, ovate-oblong, serrate, more or less pubescent beneath, 1-2½ in. long; stipules scarcely dilated, sometimes pectinate; petioles prickly: fls. usually corymbose, double, red, pink or white, sometimes striped; pedicels and receptacles glandular-hispid; sepals deciduous, reflexing during flowering-time: fr. obovate. June, July, and again in autumn. Red. Ros. (2:16, 6). W.R. 124. Origin unknown: intro. to Eu. from Asia Minor in the 16th century. Var. *trigintipetala*, Dieck, with semi-double red fls., is considered to be the rose chiefly cult. in S. E. Eu. for the manufacturing of attar. Gt. 38, p. 129. G.C. III. 7:45.

20. *alba*, Linn. Upright shrub, becoming 6 ft. high: sts. with scattered hooked prickles and sometimes with bristles: lfts. usually 5, broadly ovate or broadly elliptic, serrate, pubescent beneath, 1-2 in. long: upper stipules dilated: fls. more or less double, usually several, white, fragrant; pedicels glandular-hispid; receptacle usually smooth: fr. ovate, scarlet. June. Origin unknown, probably hybrid of *R. gallica* and *R. dumetorum*. Var. *rubicunda*, Roessig (*R. incarnata*, Mill. *R. alba* var. *incarnata*, Pers.). Fls. double, white tinged with pink. W.R. 137.

21. *francofurtana*, Muenchh. (*R. turbinata*, Ait.). Upright shrub, attaining 6 ft.: sts. with straight or hooked prickles: flowering branches almost unarmed: lfts. 5-7, oval, serrate, pubescent beneath; upper stipules much dilated: fls. 1-3, single or double, purple, 2-3 in. across, slightly fragrant; pedicels and receptacle glandular-hispid only at the base; sepals erect after flowering, entire or nearly so: fr. turbinate. June.



3443. *Rosa palustris* ($\times \frac{1}{2}$). No. 28.

Supposed hybrid of *R. gallica* and *R. cinnamomea*. Red. Ros.(3:23, 1).

Section 6. CANINE. Many species in Eu., N. Afr. and W. Asia. Upright shrubs, with scattered, usually hooked and numerous prickles: upper stipules dilated: corymb usually many-fl., with dilated bracts; outer sepals pinnate, reflexed after flowering and caducous or erect and persistent.

- A. Lvs. pubescent, at least beneath, or glandular.
- B. Prickles slender, straight or slightly curved.
- C. Lfts. large, to 2 in. long: fr. large, to 1 in. across.....22. *pomifera*
- CC. Lfts. smaller: branchlets purple, bloomy: fr. smaller.....23. *mollis*
- BB. Prickles hooked, stout.
- C. Under side of lfts. glandular.....24. *rubiginosa*
- CC. Under side of lfts. pubescent.....25. *dumetorum*
- AA. Lvs. glabrous.
- B. Foliage bright or dark green.....26. *canina*
- BB. Foliage bluish green, tinged with red. 27. *rubrifolia*

22. *pomifera*, Herrm. (*R. villosa*, Linn., in part). Upright, densely branched shrub, attaining 6 ft., with almost straight spines: lfts. 5-7, oval to ovate-oblong, acute or obtuse, doubly glandular-serrate, grayish green, pubescent above, tomentose beneath, rarely glabrescent, 1-2 in. long: fls. 1-3, pink, $1\frac{1}{2}$ -2 in. across, on bristly and glandular pedicels: fr. scarlet, ovoid or subglobose, to 1 in. across, hispid, with persistent erect sepals. June, July. Eu., W. Asia. B.M. 7241. W.R. 141.—Hardy rose, with large ornamental fr.

23. *mollis*, Smith (*R. villosa* var. *mollissima*, Rau). Upright shrub, to 4 ft.: branchlets purple, more or less bloomy; prickles sometimes $\frac{1}{2}$ in. long: lfts. 5-7, broadly oval, rarely oval-oblong, doubly serrate, pubescent



3444. *Rosa carolina* var. *triloba*
($\times \frac{3}{2}$) No. 30.

above, tomentose and usually silky beneath, $\frac{1}{2}$ - $1\frac{1}{2}$ in. long: fls. 1-3, $1\frac{1}{2}$ -2 in. across, deep pink, rarely white; pedicels usually only sparingly glandular: fr. small, glabrous or stipitate-glandular. June. Eu., W. Asia. W.R. 138.

24. *rubiginosa*, Linn. (*R. Eglantaria*, Linn.). SWEETBRIAR. EGLANTINE. Dense shrub, attaining 6 ft., with hooked prickles often mixed with bristles: lfts. 5-7, orbicular to oval, doubly glandular-serrate, dark green above and glabrous, pale beneath and often pubescent, glandular on both sides, $\frac{1}{2}$ - $1\frac{1}{2}$ in. long: fls. 1-3, on hispid short pedicels, bright pink, $1\frac{1}{2}$ -2 in. across; receptacle usually glandular-hispid: fr. subglobose or ovoid, orange-red to scarlet, with upright-spreading, usually caducous sepals. June. Eu.; naturalized in some localities in the East. B.B. (ed. 2) 2:286. W.R. 145.—A handsome hardy rose of compact habit, with bright green foliage exhaling a very agreeable aromatic odor. There are some double forms and hybrids with other species.



3445. *Rosa foliolosa*. ($\times \frac{3}{2}$)

25. *dumetorum*, Thuiller. Upright shrub with spreading or recurving branches with stout hooked prickles: lfts. 5-7, close, oval-orbicular to elliptic, usually simply serrate, pubescent on both sides or only below on the veins, 1- $1\frac{1}{2}$ in. long: fls. solitary to many, about 2 in. across; pedicels glabrous or stipitate-glandular: fr. ovoid to subglobose, orange-red, about $\frac{3}{4}$ in. long, usually glabrous. June. Eu., W. Asia, N. Afr. W.R. 132.—Very close to the following species and chiefly distinguished by the pubescence.

26. *canina*, Linn. DOG ROSE. Upright shrub, attaining 10 ft. or more, with often recurving branches: prickles stout, hooked: lfts. 5-7, oval or elliptic, doubly serrate, glabrous or slightly pubescent or somewhat glandular beneath, $\frac{3}{4}$ - $1\frac{1}{2}$ in. long: fls. 1-3, light pink, on usually glabrous pedicels; sepals reflexed, caducous: fr. ovate, orange-red, or scarlet, glabrous. June. Eu., N. Afr., W. Asia; naturalized in some localities. W.R. 126. B.B. (ed. 2) 2:284.—Much used as stock for grafting. Var. *exilis*, Keller (*R. exilis*, Crépin). Low form with small lfts. about $\frac{1}{2}$ in. long, and small pink fls. about 1 in. across. W.R. 127.

27. *rubrifolia*, Vill. (*R. glauca*, Pourr. *R. ferruginea*, Déségl., not Vill.). Upright shrub, attaining 6 ft., with slender, purplish branches covered with glaucous bloom: prickles few, hooked or straight: lfts. 7-9, elliptic or ovate-lanceolate, simply serrate, bluish green and more or less tinged with red, $\frac{3}{4}$ - $1\frac{1}{2}$ in. long: fls. 1-3 or more, pink, $1\frac{1}{2}$ in. across, on usually hispid-glandular pedicels; sepals long, with dilated apex, upright-spreading, tardily caducous: fr. subglobose, scarlet. June. Mountains of Cent. and S. Eu. B.R. 430. G.W. 7, p. 139. W.R. 133.—A very striking rose on account of its reddish foliage: fls. less conspicuous. Hardy North and prefers partial shade.

Section 7. CAROLINÆ. Contains only American species. Upright, mostly low shrubs: sts. slender, with usually straight prickles, placed in pairs and often mixed with bristles: upper stipules usually narrow: corymbs generally few-fl.; sepals spreading after flowering, caducous, the outer ones entire or with few erect lobes: achenes inserted exclusively at the bottom of the usually depressed-globose receptacle.

- A. Pedicels rather long: lfts. 5-9.
- B. Lfts. finely many-toothed: prickles usually hooked: stipules convolute. 28. *palustris*
- BB. Lfts. coarsely toothed: prickles usually straight and slender: stipules flat.
- C. Branches prickly only at the nodes or unarmed, only vigorous shoots bristly.
- D. Prickles hooked: lfts. shining above. 29. *virginiana*
- DD. Prickles straight or nearly so: lfts. dull above. 30. *carolina*
- CC. Branches densely bristly. 31. *nitida*
- AA. Pedicels very short: lfts. 7-11, small and narrow. 32. *foliolosa*

28. *palustris*, Marsh. (*R. carolina*, Auth., not Linn. *R. corymbosa*, Ehrh. *R. pennsylvanica*, Michx.). Fig. 3443. Upright shrub, attaining 8 ft., with slender sts.: lfts. usually 7, elliptic to narrow-oblong, acute at both ends, usually pubescent beneath, $\frac{3}{4}$ -2 in. long; stipules narrow: fls. usually corymbose, pink, about 2 in. across: fr. depressed-globose, glandular-hispid, about $\frac{1}{2}$ in. high, like those of the following species. June-Aug. Nova Scotia to Minn., south to Fla. and Miss., preferring swampy and moist ground. Em. 2:488. B.B. (ed. 2) 2:285. W.R. 1:68. Mn. 1, p. 86. Var. *Nuttalliana*, Hort., has larger fls. appearing later and continuing until Sept.

29. *virginiana*, Mill. (*R. lucida*, Ehrh. *R. humilis* var. *lucida*, Best). Shrub, 6 ft. high, with few or no suckers: prickles sometimes hooked: lfts. 7-9, elliptic to obovate-elliptic, dark green and shining above, thickish, often slightly pubescent beneath, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long; stipules somewhat dilated: fls. usually few or solitary, about 2 in. across; sepals usually entire: fr. like that of the preceding. June, July. Newfoundland to N. Y. and Pa. B.B. (ed. 2) 2:285. Gn. 55, p. 428; 71, p. 493. Gt. 56:1564, fig. 2. W.R. 63.—Well adapted for borders of shrubberies, handsome in summer with its shining foliage and bright pink fls.; ornamental in winter with the brownish red sts. and red frs. remaining plump until the following spring. Var. *alba*, Willmott.



3446. Semi-double
Rosa rugosa (X $\frac{1}{2}$).
No. 33.

has white fls. and green sts. A.F. 12:1098. Gng. 5:306. M.D.G. 1904:205. W.R. 63a. Var. *plena*, Hort. (*R. rāpa*, Bosc). With double fls.

30. *carolina*, Linn. (*R. humilis*, Marsh. *R. parviflora*, Ehrh. *R. virginiana* var. *humilis*, Schneid. *R. Lyoni*, Pursh). Fig. 3432. Shrub, 3 ft. or sometimes 6 ft. high, spreading by means of numerous suckers, with slender prickles and usually numerous bristles: lfts. 5-7, resembling those of the former, but narrower, thinner, not shining, usually pubescent beneath: fls. often solitary; outer sepals lobed. June. Maine to Ga., west to Wis. and Okla. W.R. 64.—Much resembling the preceding, which is often considered a variety of this species. Var. *villōsa*, Rehd. (*R. humilis* var. *villōsa*, Best). Lvs.



3447. Fruits of *Rosa rugosa*. (X $\frac{1}{2}$)

villous-pubescent beneath, thickish. Var. *grandiflora*, Rehd. (*R. humilis* var. *grandiflora*, Baker). Fls. 2 in. across: lfts. larger. W.R. 66. Var. *triloba*, Rehd. (*R. humilis* var. *triloba*, Wats.). Fig. 3444. Petals 3-lobed. G.F. 2:77 (adapted in Fig. 3444).

31. *nitida*, Willd. Low upright shrub, 1 $\frac{1}{2}$ ft. high: branches covered with straight prickles and numerous bristles: lfts. 7-9, narrowly oblong, acute at both ends, bright green and shining above, glabrous, $\frac{1}{2}$ -1 in. long: fls. usually solitary, 1-2 in. across, on slender glandular-hispid pedicels; sepals entire. June, July. Newfoundland to Mass. B.B. (ed. 2) 2:285.

32. *foliolosa*, Nutt. Fig. 3445. Low shrub, 1 $\frac{1}{2}$ ft. high: sts. with rather few slender prickles, sometimes almost unarmed: lfts. 7-9, narrow or linear-oblong, bright green and shining above, glabrous or pubescent on the midrib beneath, $\frac{1}{3}$ -1 in. long: fls. solitary or few, pink, about 1 $\frac{1}{2}$ in. across; pedicels and receptacle smooth or sparingly glandular-hispid: fr. globose, with rather few achenes. May, June. Ark. and Okla. to Texas. G.F. 3:101 (adapted in Fig. 3445).—Like the preceding, a handsome dwarf shrub with graceful foliage.

Section 8. CINNAMOMEÆ. Many American, Asiatic, and European species. Erect shrubs, with usually straight prickles, in pairs or scattered, and often with numerous bristles: lfts. 5-11: corymbs usually many-fl., with dilated bracts; sepals generally entire, upright after flowering, and persistent, rarely deciduous: receptacle usually smooth.

- A. Branches and prickles tomentose. 33. *rugosa*
- AA. Branches and prickles glabrous.
- B. Stipules, at least on the shoots, more or less convolute. 34. *cinnamomea*
- BB. Stipules flat.
- C. Prickles nearly always wanting (sometimes present in No. 37).
- D. Lfts. simply serrate, 5-7.
- E. Rachis of lf. puberulous: fls. single. 35. *blanda*
- EE. Rachis of lf. glabrous: fls. double. 36. *Lheritierana*
- DD. Lfts. doubly serrate, 7-9: fr. oblong to ovoid. 37. *pendulina*
- CC. Prickles present.
- D. Lfts. 3-7, only on shoots occasionally 9: calyx persistent.
- E. Upper stipules enlarged.
- F. Fls. usually several, 1-2 in. across: lfts. generally obovate, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long. 38. *Woodsi*
- FF. Fls. usually solitary, about 2 in. across or more: lfts. 1-2 in. long.

- a. Flowering branchlets usually unarmed: lfts. generally ovate.....39. *nuttiana*
 gg. Flowering branchlets prickly: lfts. generally oblong.....40. *acicularis*
 hh. Upper stipules narrow, like the lower.
 f. Prickles hooked: lfts. doubly serrate.....41. *californica*
 ff. Prickles straight, usually slender: lfts. usually simply serrate.....42. *pisocarpa*
 dd. Lfts. 7-11.
 n. Sepals persistent.
 f. Fls. corymbose; sepals pinnate or serrate.
 g. Shrub 1-2 ft.: sts. with numerous slender prickles.....43. *helioophila*
 gg. Shrub to 10 ft.: sts. with paired stout wide-based prickles.....44. *setipoda*
 ff. Fls. 1-3; sepals entire.
 g. Lfts. 1-2 in. long, pubescent beneath: fls. 1-3. 45. *macrophylla*
 gg. Lfts. $\frac{1}{4}$ -1 $\frac{1}{4}$ in. long, glabrous or nearly so beneath: fls. usually solitary, short-stalked.....46. *Moyesii*
 hh. Sepals with their base falling off as a whole: fls. solitary on short lateral branchlets: lfts. 5-9, $\frac{1}{4}$ -1 in. long.
 f. St. with bristles and prickles: lfts. doubly serrate, $\frac{1}{4}$ -1 in. long.....47. *gymnocarpa*
 ff. Sts. without bristles: lfts. simply serrate.....48. *Willmottii*

33. *rugosa*, Thunb. (*R. ferox*, Lawr. *R. Repehiana*, André & Lind. *R. coruscans*, Waits). Figs. 3448-3448.



3449. Bud of Madame Georges Bruant rose. One of the *rugosa* hybrids ($\times \frac{3}{4}$). No. 33.

Upright shrub, attaining 6 ft., with stout sts. densely beset with prickles and bristles: lfts. 5-9, oval to obovate-oval, rugose, shining and dark green above, glaucescent and pubescent beneath, thick and firm, $\frac{3}{4}$ -2 in. long; petioles tomentose and bristly; stipules dilated: fls. solitary or few, purple or white, $2\frac{1}{2}$ -3 $\frac{1}{2}$ in. across:



3448. *Rosa rugosa* ($\times \frac{3}{4}$). No. 33.

bracts large; pedicels prickly; receptacle smooth: fr. depressed-globose, brick-red, to 1 in. across. May-Sept. N. China, Korea, Japan. S.Z. 1:28. B.R. 420. Gt. 30:1049; 42, p. 537. G.C. II. 14:372. Gn. 46, p. 324; 52:384; 55, p. 434. I.H. 18:47. Gng. 1:7; 5:339. A.G. 13:342, 344; 18:567. C.L.A. 2:76; 7:624. F.E. 18:6. J.H. III. 45:159.—Forms of typical *R. rugosa*, which is sometimes distinguished as var. *Thunbergiana*, C. A. Mey., are the following: Var. *alba*, Rehd. (var. *albiflora*, Koidsumi), with white fls. Gn. 9:452. G. 8:261. Var. *albo-plena*, Rehd., with double white fls. Var. *rosea*, Hort., with pink fls. Var. *rubra*, Hort., with purple fls. Var. *rubro-plena*, Rehd., with double purple fls. Gt. 24:846. Geographical varieties, not of garden origin, are the following two: Var. *Chamissoniana*, C. A. Mey. (*R. pubescens*, Baker, not Roxbg.). Bristles almost entirely absent on the branches: lfts. narrower and smaller, less rugose. A double-fl. form of this variety is sometimes cult. in Cent. China, but apparently not yet intro. into western gardens. Var. *kamschatica*, Regel (*R. kamschatica*, Vent.). With slender less densely armed branches, thinner less rugose lvs. and smaller fls. and frs. B.M. 3149. B.R. 419.—*R. rugosa* is one of the most ornamental and at the same time hardiest of the single roses, valuable for shrubberies; it is very handsome on account of its dark green shining foliage, large fls. appearing during the whole summer, bright red conspicuous frs., and its beautiful orange and scarlet fall coloring. It is also attractive in winter by reason of its stout, densely armed sts. Large numbers of hybrids have been raised. By crossing with double-fl. garden roses, *R. rugosa* has given rise to a new race of hybrid roses remarkable for their hardiness and long blooming season; one of the best known is Mme. Georges Bruant (Fig. 3449), with double white fls., a cross of *R. rugosa* and the Tea rose Sombreuil. Another cross with a form of *R. chinensis* is *R. calocarpa*, Willmott (*R. rugosa* var. *calocarpa*, Bruant), with single rose-colored fls. and handsome fr. produced very abundantly. Gn. 46, p. 548; 52, p. 384. R.H. 1895, pp. 446, 447. I.H. 42, p. 15. W.R. 60. Remarkable for its large frs. and large fls. is *R. microgosa*, Henkel (*R. rugosa* \times *R. microphylla*, *R. Vil-morinii*, Bean). Upright, very spiny shrub: lfts. 7-11, small, pubescent: fls. pink, 3-4 in. across: fr. depressed-globose, about 1 $\frac{3}{4}$ in. across, prickly, orange-red. Gt. 59:1581. R.H. 1905:144. It is of vigorous growth and hardy and will probably make a good hedge plant. Hybrids are also known with *R. multiflora* (see *R.*

Iwara under No. 2), with *R. Wichuraiana* (see *R. Jacksonii* under No. 3), with *R. cinnamomea*, with *R. spinosissima*, with *R. carolina*, a pretty rose with purplish red fls. (W.R. 65), with *R. blanda*—*R. warleyensis*, Willmott, a handsome rose with pink fls. and 5-7 small lfts. (W.R. 59), with *R. palustris*—*R. Spaethiana*, with large purple corymbose fls. (Gt. 51:1504, 3), and there are probably others.

34. *cinnamomea*, Linn. CINNAMON ROSE. Sts. slender, 6 ft. high, with hooked prickles, flowering branches sometimes unarmed: lfts. 5-7, sometimes 3, on lvs. of flowering branchlets, oblong, simply serrate, dull green, densely pubescent beneath, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long: fls. solitary or few, purple, about 2 in. across, on short, naked pedicels: fr. depressed-globular, scarlet. May, June. Eu., N. and W. Asia. A.G. 13:343. W.R. 45. Var. *fœcundissima*, W. D. Koch (*R. fœcundissima*, Muenchh.). Figs. 3450, 3451. With double fls. Sometimes escaped from cult. in the East.



3450. *Rosa cinnamomea* var. *fœcundissima*.



3451. *Rosa cinnamomea* var. *fœcundissima*. One of the old-fashioned hardy roses. ($\times \frac{1}{2}$)

35. *blanda*, Ait. (*R. virginiana*, Koehne, not Mill. *R. fraxinifolia*, Borkh.). Sts. slender, 5 ft. high, with few slender prickles or unarmed: lfts. 5-7, elliptic to obovate-oblong, usually acute, simply serrate, glabrous or pubescent beneath, $\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; stipules dilated: fls. usually several, pink, 2-2 $\frac{1}{2}$ in. across, on smooth peduncles: fr. globular, sometimes elongated. May, June. Newfoundland to N. Y., west to Wis. and Ill. B.B. (ed. 2) 3:283. W.R. 104. Var. *Willmottiae*, Baker. Sts. red: lfts. smaller: fls. bright coral-pink. W.R. 104, 3.

36. *Lheritierana*, Thory (*R. reclinata*, Thory. *Boursaultii*, Hort.). Supposed hybrid of *R. pendulina* and *R. chinensis*. Climbing to 12 ft., with slender, sparingly prickly branches: lfts. 3-7, oblong-ovate, glabrous: fls. in corymbs, purple, double or semi-double, nodding: fr. subglobose, smooth. Red. Ros. (3:26, 3). W.R. 102.—Varying with lighter and deeper colored and more or less double fls.

37. *pendulina*, Linn. (*R. alpina*, Linn.). Fig. 3432. Sts. slender, 3 ft. high, usually nearly unarmed, rarely prickly and bristly: lfts. 7-9, oblong-ovate or oblong-elliptic, obtuse, doubly glandular-serrate, usually gla-

brous, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long: fls. pink, usually solitary or 2-5, to 2 in. across; pedicels and receptacle usually smooth: fr. usually nodding, oblong or ovate, with elongated neck, scarlet. May, June. Mountains of Eu. B.R. 424. J.H. III. 43:9. W.R. 99.—Handsome free-flowering shrub. Var. *pyrenæica*, W. D. Koch (*R. pyrenæica*, Gouan). Dwarf, with the pedicels and usually also the receptacles glandular-hispid. B.M. 6724. Gn. 27:544. Possibly a hybrid of this species and *R. spinosissima* is *R. Malyi*, Kerner, similar in foliage to *R. spinosissima*, but with bright red fls. W.R. 100; one of the handsomest of the wild roses.

38. *Woodsii*, Lindl. Sts. to 3 ft. high, with slender, straight or recurved prickles, often bristly: lfts. 5-7, or sometimes 9 on shoots, obovate to oblong, mostly simply serrate, usually pubescent beneath, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: fls. corymbose or solitary, pink, rarely white, 1 $\frac{1}{2}$ -2 in. across, on very short smooth pedicels: fr. globose, with short neck. June, July. Sask. to Colo. and Mo. B.R. 976. B.B. (ed. 2) 2:284. W.R. 77. Var. *Fendleri*, Rydb. (*R. Fendleri*, Crépin). Slenderer and often taller: lfts. usually smaller, usually doubly glandular-serrate, often glabrous, fls. and fr. somewhat smaller. Brit. Col. to W. Texas and New Mex. W.R. 56.

39. *nutkana*, Presl. Fig. 3452. Sts. stout, 5 ft. high, with usually straight prickles and sometimes bristly: lfts. 5-7, or sometimes 9 on shoots, broadly elliptic to oblong-lanceolate, generally rounded at the base, usually doubly glandular-serrate, almost glabrous, often glandular beneath, $\frac{1}{2}$ -2 in. long: fls. usually solitary, pink, 2-2 $\frac{1}{2}$ in. across: fr. globose, without neck. June, July. Alaska to Ore. and Utah. G.F. 1:449 (adapted in Fig. 3452). W.R. 75.—Has the largest fls. of the western species; pink. Var. *hispida*, Fern., has the receptacle glandular-hispid.

40. *acicularis*, Lindl. Sts. low, densely prickly: lfts. 3-7, broadly elliptic to narrowly oblong, rounded at base, simply or doubly serrate, pubescent beneath, $\frac{1}{2}$ -2 in. long: fls. solitary, deep rose, 1 $\frac{1}{2}$ -2 in. across, fragrant; sepals entire and nearly glabrous: fr. usually pyriform, $\frac{1}{2}$ -1 in. long. May, June. Alaska to Ont. and Colo., N. Eu., N. Asia, Japan. B.B. (ed. 2) 2:283.—A very variable species. Var. *Bourgeauiana*, Crépin (*R. Sayeri*,



3452. *Rosa nutkana*. ($\times \frac{1}{2}$)

Schwein. *R. acicularis* var. *Sayeri*, Rehd.). Fig. 3453. Lfts. glandular and pubescent beneath, usually somewhat doubly glandular-serrate: fls. larger, often 2 $\frac{1}{2}$ in. across: fr. usually globular. Ont. to Brit. Col. and Colo. Var. *Engelmannii*, Crépin in herb. (*R. Engelmanni*, Wats.). Fig. 3454. Similar to the preceding: lfts. distinctly doubly glandular-serrate: fr. oblong, to 1 in. long. Colo. to Brit. Col. G.F. 2:377 (adapted in Fig. 3454). Var. *nipponensis*, Hook. f. Lfts. smaller, $\frac{1}{2}$ - $\frac{3}{4}$ in. long; petioles bristly: branchlets and

pedicels glandular-hispid: fls. $1\frac{1}{2}$ in. across. Japan. B.M. 7646. W.R. 47.

41. *californica*, Cham. & Schlecht. Sts. 8 ft. high, with stout, hooked or straight prickles, often bristly: lfts. 5-7, broadly elliptic to oblong-obovate, simply or doubly glandular-serrate, pubescent beneath or on both sides, often glandular, $\frac{1}{2}$ - $1\frac{1}{2}$ in. long: fls. on slender, usually smooth pedicels, over 1 in. across, few or several in dense corymbs, pink: fr. globose-ovate, usually with a prominent neck. June-Aug. Brit. Col. to Calif. W.R. 72 (a semi-double form).

42. *pisocarpa*, Gray. Sts. thin, with slender, straight or ascending prickles, without bristles, sometimes unarmed: lfts. 5-7, oblong to oblong-obovate, acute or obtuse, simply serrate, pubescent or sometimes glabrous beneath, $\frac{1}{2}$ - $1\frac{1}{2}$ in. long: fls. pink, about 1 in. across, on short usually smooth pedicels, in several to many-fl. corymbs: fr. globose, with a very short neck. June-Aug. Brit. Col. to Ore. B.M. 6857.

43. *heliophila*, Greene (*R. pratincola*, Greene, not H. Braun). Low shrub, to 2 ft.: sts. very prickly, usually green: lfts. 7-11, broadly elliptic to obovate-oblong, acute or obtuse, cuneate at the base, simply serrate, pubescent beneath at least on the veins, $1\frac{1}{4}$ in. long; stipules rather narrow, entire or glandular-toothed above: fls. corymbose, pink, $1\frac{1}{2}$ in. across; pedicels and receptacle glabrous; outer sepals lobed: fr. globose, $\frac{1}{2}$ - $\frac{1}{2}$ in. across, red. June. Man. to Mont., south to Mo. and Texas, prairies. B.B. (ed. 2) 2:284.

Mn. 3:116. W.R. 105.—Adapted for dry slopes and barren places. Var. *alba*, Rehd. With white fls. about 2 in. across.—*R. pratincola* has been confused with *R. arkansana* and is sometimes cult. under the latter name. The true *R. arkansana*, Porter, differs in its glabrous foliage, glandular and bristly stipules, and reflexed sepals; it is known only from Colo.

44. *setipoda*, Hemsl. & Wilson (*R. macrophylla* var. *crasse-aculeata*, Vilm.). Shrub, to 10 ft.: branches with paired straight, wide-based prickles: lvs. $2\frac{1}{2}$ -7 in. long; lfts. 7-9, elliptic or ovate, obtuse or acutish, serrate or doubly serrate, dark green and glabrous above, glaucous beneath and puberulous on the veins, $1\frac{1}{4}$ - $2\frac{1}{2}$ in. long: fls. about 2 in. across, pale pink, in loose corymbs; pedicel and receptacle copiously glandular-hispid; sepals ovate-lanceolate, long-caudate with foliaceous serrate tips: fr. oblong-ovoid with narrow neck, about 1 in. long, deep red. June. Cent. China. B.M. 8569. J.H.S. 27:486.—This handsome rose has proved fairly hardy at the Arnold Arboretum and is very showy in June with its ample clusters of large pink

fls. and again in fall with the nodding clusters of deep red hips.

45. *macrophylla*, Lindl. Large, upright shrub: flowering branches with few prickles or unarmed: lfts. 9-11, elliptic-ovate to elliptic-oblong, acute, simply serrate, glabrous above, pubescent beneath, 1-2 in. long; stipules glandular-ciliate: fls. 1-3, red, about 2 in. across; pedicels and receptacle glandular-setose or naked; sepals lanceolate, long-caudate, entire: fr. oblong-ovoid, red, $1\frac{1}{2}$ in. long. Himalayas. W.R. 50. This species is tender and rarely cult., but several of the allied Chinese species when first intro. were distributed as *R. macrophylla* or varieties of *R. macrophylla*, such as *R. Moyesii*, *R. setipoda*, *R. Davidii*, *R. sertata*, *R. persetosa* (see suppl. list for the last three species); to *R. persetosa* belong *R. macrophylla* var.

acicularis, Vilm., and *R. macrophylla* f. *gracilis*, Vilm., while f. *gracilis*, Focke, belongs partly to *R. sertata* and partly to *R. Moyesii*.

46. *Moyesii*, Hemsl. & Wilson (*R. macrophylla* var. *rubro-staminea*, Vilm. *R. Fargesii*, Hort.). Shrub, to 10 ft.: branches with scattered short straight prickles: lfts. 7-13, nearly sessile, ovate or elliptic to ovate-oblong or sometimes nearly orbicular, closely serrulate, glabrous except the slightly pilose midrib beneath, $\frac{1}{4}$ - $1\frac{1}{4}$ in. long; rachis puberulous, glandular and bristly; stipules wide, glandular-ciliate: fls. solitary or 2, deep blood-red, $1\frac{3}{4}$ - $2\frac{1}{2}$ in. across; pedicels short, stipitate-glandular like the receptacle, or the latter glabrous; sepals are ovate, abruptly long-caudate: fruit deep orange-red, oblong-ovoid, narrowed into a neck, $2\frac{1}{2}$ in. long. June. W. China. B.M. 8338. J.H.S. 27:489. V.F. 95. G. 37:427. Gn. 72, p. 313. J.H. III. 56:587. G.M. 51:478.—A strikingly beautiful rose; its fls. vary considerably in color, from dark blood-red, the color of the typical form, through deep rose to light pink. The extreme light pink form has been distinguished as f. *rosea*, Rehd. & Wilson.

47. *gymnocarpa*, Nutt. Sts. slender, attaining 10 ft., with straight slender prickles and bristles: lfts. 5-9, broadly elliptic to oblong, doubly glandular-serrate, usually glabrous, $\frac{1}{2}$ -1 in. long: fls. solitary on short lateral branchlets, pale pink, about 1 in. across; sepals short: fr. orange-red, globose, small; calyx drops before maturity. June, July. Brit. Col. to Calif., east to Mont. W.R. 71.

48. *Willmottiae*, Hemsl. Densely branched shrub, 5-10 ft., nearly glabrous: branches with slender paired prickles: lvs. crowded, $\frac{3}{4}$ - $1\frac{1}{4}$ in. long; lfts. usually 7, elliptic to obovate or sometimes nearly orbicular, usually rounded at the apex, closely and nearly doubly serrate, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: fls. rose-purple, $1\frac{1}{4}$ in. across, solitary, short-stalked, on short lateral branchlets; sepals lanceolate, caudate: fr. subglobose, $\frac{1}{2}$ - $\frac{1}{2}$ in. long, bright orange-red; the calyx tardily falling off at maturity. May, June. W. China. B.M. 8186.—Very pretty rose, not to be confused with *R. Willmottiana*, Léveillé, which is *R. longicuspis* (see suppl. list), nor with *R. blanda* var. *Willmottiae*, Baker.



3453. *Rosa acicularis* var. *Bourgeauiana* ($\times\frac{1}{2}$). No. 40.

Section 9. PIMPINELLIFOLIÆ. *Few Old-World species. Upright shrubs, usually low: prickles straight, scattered, usually numerous and mixed with bristles: lfts. very small, usually 9; stipules narrow, with divergent and dilated auricles: fls. solitary, without bracts; sepals entire, erect and persistent.*

A. Flowering branches bristly and prickly:

lfts. usually rounded at the base: fls.

pink, white, or yellow: fr. black......49. *spinossissima*

AA. Flowering branches without bristles:

lfts. usually cuneate at the base: fls.

yellow: fr. scarlet......50. *Hugonis*

49. *spinossissima*, Linn. (*R. pimpinellifolia*, Linn.). SCORCH ROSE. Low shrub, with upright recurring or spreading branches, 3-4 ft. high, usually densely beset with slender prickles and bristles: lfts. 5-11, usually 9, orbicular to oblong-ovate, simply or doubly serrate, glabrous, sometimes glandular beneath, $\frac{1}{4}$ - $\frac{3}{4}$ in. long: fls. solitary, but usually very numerous along the sts., pink, white, or yellowish, $1\frac{1}{4}$ -2 in. across; pedicels smooth or glandular-hispid: fr. globular, black. May, June. Eu., W. Asia to China. Gn. 55, p. 425; 60, p. 24; 74, p. 598. W.R. 82.—Very variable. *Var. altatica*, Rehd. (*R. altatica*, Willd. *R. grandiflora*, Lindl.). More vigorous: fls. large, white; pedicels smooth. B.R. 888. Gn. 53:170. A.F. 12:1099. Gng. 5:307. F.E. 18:7. C.L.A. 7:620; 20:20. G. 31:389; 34:501. W.R. 86.

Var. myriacantha, Koehne (*R. myriacantha*, DC.). Branches very prickly: lvs. doubly glandular-serrate, very small: fls. small, white, blushed. Red. Ros. (1:6, 7). W.R. 88. *Var. inermis*, Rehd. (*var. mitissima*, Koehne. *R. pimpinellifolia* *var. inermis*, DC. *R. mitissima*, Gmel.). Branches almost unarmed: fls. pink. Red. Ros. (1:6, 6). *Var. hispida*, Koehne (*R. hispida*, Sims. *R. lutescens*, Pursh). Taller: lfts. simply serrate: pedicels smooth: fls. sulfur-yellow, $2\frac{1}{2}$ -3 in. across, rather large. B.M. 1570. Gn. 56:398; 62, p. 17. J.H.S. 27:508. W.R. 87. *Var. luteola*, Andr. (*R. ochroleuca*, Swartz). Similar to the preceding variety: fls. pale yellow, 2 in. across: lfts. 7. G. 28:281. *Var. Andrewsii*, Willmott. A low form with double red fls. W.R. 89. There are also other



3454. *Rosa acicularis* var. *Engelmannii* ($\times \frac{3}{4}$). No. 40.

varieties with double or semi-double, pink, white (G.W. 7, p. 139), or yellow fls. (Gn. 29:448). Several hybrids are known. *R. hibernica*, Smith, a low shrub with glaucous green foliage and small pale pink fls., is a hybrid with *R. canina*. W.R. 98. *R. reversa*, Waldst. & Kit. (*R. rubella*, Smith), with dark green foliage, red fls. and scarlet, pendulous ovate-oblong frs., is a hybrid with *R. pendulina*.

50. *Hugonis*, Hemsl. Fig. 3455. Shrub, to 6 ft.: branches with rather stout compressed prickles, on the shoots mixed with bristles: lfts. 5-11, oval or obovate, to elliptic-oblong, usually broadly cuneate at the base, finely serrate, glabrous, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. $2\frac{1}{2}$ in. across, yellow, solitary on slender glabrous pedicels; sepals lanceolate: fr. depressed-globose, deep scarlet. May, June; fr. Aug. W. China. B.M. 8004. G. 35:417. G. M. 51:243. Gn. 71, p. 295. W.R. 95.—A very handsome free-flowering rose; hardy.



3455. *Rosa Hugonis*. ($\times \frac{1}{2}$)

Section 10. LUTEÆ. *Four Asiatic species. Upright or somewhat sarmentose shrubs, with scattered, straight or hooked prickles, without bristles: stipules usually narrow, with divergent and dilated auricles: fls. yellow, without bracts; sepals usually pinnate, persistent, upright.*

A. Prickles straight: lfts. doubly serrate,

dark green......51. *fœtida*

AA. Prickles hooked: lfts. simply serrate, [ica
bluish green......52. *hemisphær-*

51. *fœtida*, Herrm. (*R. lutea*, Mill. *R. Eglantaria*, Linn., not Mill.). AUSTRIAN BRIAR. Shrub with long, slender, often sarmentose or climbing brown sts., becoming 10 ft. high, usually with straight prickles: lfts. 5-9, broadly ovate to oval, doubly glandular-serrate, dark green above, often glandular, $\frac{1}{2}$ -2 in. long; stipules glandular-serrate: fls. sometimes several, but without bracts to the main pedicel, bright yellow, $2\frac{1}{2}$ in. across, of unpleasant odor: fr. globular. June. W. Asia. B.M. 363. Gn. 53:22. W.R. 90. *Var. bicolor*, Willmott (*R. lutea* *var. punicea*, Aschers. & Graebn. *R. punicea*, Mill. *R. bicolor*, Jacq.). COPPER AUSTRIAN BRIAR. Fls. orange-scarlet within. B.M. 1077. Gn. 53, p. 23; 55, p. 425. W.R. 91. *Var. persiana*, Rehd. (*R. lutea* *var. persiana*, Lem. *R. lutea* *var. plena*, Hort.), PERSIAN YELLOW, is a double-fl. form; it is more double and more free-flowering than the Sulphur Rose. F.S. 4:374. *Var. Harrisonii*, Hort., HARRISON'S YELLOW ROSE, is of paler color and a little less double than Persian Yellow, but it blooms more freely, is more vigorous, hardier and easier to grow. It is of American origin and may be a hybrid of the Austrian Briar rose with *R. spinossissima*. F.E. 18:6.

52. *hemisphærica*, Herrm. (*R. glaucophylla*, Ehrh. *R. sulphurea*, Ait. *R. Rapinii*, Boiss. & Bal.). SULPHUR ROSE. Closely allied to the preceding: sts. slender, with hooked prickles: lfts. obovate, cuneate at the base, simply serrate, bluish green: fls. usually solitary, double, scentless, light yellow; pedicels glandular-hispid. June. W. Asia. B.R. 46. W.R. 93.

Section 11. SERICEÆ. Three Asiatic species. Erect shrubs with the prickles in pairs; stipules narrow, with erect dilated auricles; fls. solitary, without bracts; sepals entire, persistent, and upright; petals usually 4; styles somewhat exserted.

- A. Lfts. generally ovate or obovate, 7-11: fr. slender-stalked 53. *sericea*
 AA. Lfts. generally oblong, 9-17: fr. on a thickened fleshy stalk $\frac{1}{2}$ in. long ... 54. *omeiensis*

53. *sericea*, Lindl. (*R. tetrapétala*, Royle). Attaining 12 ft., with prickly and often bristly branches: lfts. 7-11, oval or obovate, serrate, glandular or silky pubescent beneath, $\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. white, $1\frac{1}{2}$ -2 in. across; petals usually 4, rarely 5: fr. globose or turbinate. May, June. Himalayas. B.M. 5200. R.H. 1897, pp. 444, 445. J.H. III. 43:7. W.R. 52.



3456. *Rosa omeiensis*. ($\times \frac{1}{2}$)

—A graceful shrub with fern-like foliage, early white fls. and especially attractive in summer on account of the contrasting color of the red fr. and its yellow or red fleshy stalk, a feature which distinguishes it at once from any other cult. rose. Has proved hardy in Mass., while *R. sericea* is tender. Var. *pteracantha*, Rehd. & Wilson (*R. sericea* var. *pteracantha*, Franch.). Prickles much enlarged at the base, decurrent and often confluent, forming wide wings, red and translucent on the young shoots. B.M. 8218. G.C. III. 38:260, 261. Gn. 69:300. J.H.S. 27:491.—The large wing-like prickles, which are red and translucent while young, make this rose a conspicuous and striking object.

Section 12. MINUTIFOLLE. Three American species. Low shrubs with slender, scattered prickles: lfts. small, incised-serrate; stipules with dilated and divergent auricles: fls. solitary, without bracts; sepals erect, persistent, the outer ones pinnate: fr. prickly.

- A. Lfts. cuneate-obovate: fls. $1\frac{1}{2}$ -3 in. across.
 B. Branches glabrous: lfts. usually 5 ... 55. *mirifica*
 BB. Branches stellate-pubescent: lfts. usually 3. 56. *stellata*
 AA. Lfts. ovate to oblong: fls. about 1 in. across. 57. *minutifolia*

55. *mirifica*, Greene. Upright shrub, 3-4 ft.: st. green, glabrous, with slender yellowish white prickles and numerous bristles: lfts. usually broadly cuneate-obovate, incisedly or crenately dentate, the teeth sometimes glandular-serrulate, slightly pubescent on both sides or nearly glabrous, light green, $\frac{1}{3}$ - $\frac{3}{4}$ in. long: fls. solitary, deep rose-purple, $1\frac{1}{2}$ -3 in. across: fr. irregularly and broadly turbinate, wrinkled, dull red, prickly,

$\frac{1}{2}$ - $\frac{3}{4}$ in. across. April, May. New Mex., White and Sacramento Mts.—This is one of the most beautiful and the most strikingly distinct of the American roses. The fact that it flowers in its native habitat, according to the writer's observation on the Sacramento Mts., New Mex., freely a second time in Aug. indicates a horticulturally valuable trait. Not hardy N.

56. *stellata*, Wooton. Upright shrub to 2 ft.: sts. with whitish prickles, densely stellate-pubescent while young: lfts. usually 3, broadly cuneate-obovate, incisedly dentate, pubescent on both sides, somewhat rough above, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: fls. solitary, deep rose-purple, $1\frac{3}{4}$ -2 $\frac{1}{4}$ in. across: fr. turbinate, prickly. April, May. New Mex., Organ and San Andreas Mts. J.H.S. 27:457. W.R. 103.—Not hardy N.

57. *minutifolia*, Engelm. Fig. 3457. Dense shrub, to 4 ft. high: branchlets pubescent with slender brown prickles: lfts. 5-7, ovate to oblong, incisedly dentate, pubescent, $\frac{1}{6}$ - $\frac{1}{2}$ in. long: fls. short-pedicel, pink or white, about 1 in. across: fr. subglobose, hispid. April, May. Calif. G.F. 1:102 (adapted in Fig. 3457). J.H.S. 27:456.—Tender.

Section 13. BRACTEATÆ. Two Asiatic species. Shrubs with erect or sarmentose and tomentose or pubescent sts.; prickles in pairs: stipules slightly adnate and pectinate: infl. with large bracts; sepals reflexed after flowering, entire; receptacle tomentose.

58. *bracteata*, Wendl. (*R. Macartnea*, Dum.). MACARTNEY ROSE. Sts. usually procumbent or sarmentose, villous-tomentose, with stout hooked prickles: lfts. 5-9, oval to obovate, crenately serrulate, bright green above and somewhat shining, almost glabrous beneath, $\frac{1}{2}$ -2 in. long: fls. 1 or few, short-stalked, white, 2-2 $\frac{3}{4}$ in. across; sepals and receptacle densely tomentose. June-Oct. S. China, Formosa; naturalized in Fla. and La. B.M. 1377. B.B. (ed. 2) 2:268. Gn. 70, p. 192.—Handsome half-evergreen climber, not hardy N. There is a double-fl. form.

Section 14. LÆVIGATÆ. One Asiatic species. Climbing shrub, with scattered hooked prickles: lfts. generally 3; stipules almost free: fls. solitary, without bracts, large, white; sepals erect, entire, persistent.

59. *lævigata*, Michx. (*R. sinica*, Murr. *R. cherokeeensis*, Donn., *R. ternata*, Poir. *R. nivea*, DC. *R. Camellia*, Hort.). CHEROKEE ROSE. Figs. 3458, 3459. High climbing shrub, with slender green prickly branches: lfts. 3, rarely 5, elliptic-ovate to ovate-lanceolate, sharply serrate, shining and glabrous, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long: fls. solitary, white, rarely rose, 2 $\frac{1}{2}$ -3 $\frac{1}{2}$ in. across, fragrant; pedicels and receptacle densely bristly: fr. large, obovate, bristly. June. China, Formosa, Japan; naturalized in the southern states. B.M. 2847. B.R. 1922. G.C. III. 6:497. Gn. 53, p. 207; 60, p. 29; 64, p. 95; 68, p. 206; 71, p. 225. F.S.R. 1:294. G. 34:447. M.D.G. 1906:397.—Handsome climbing rose, but not hardy N. A hybrid with *R.*



3457. *Rosa minutifolia*. ($\times \frac{1}{2}$)

Banksia is *R. Fortuneana* (see No. 16). A hybrid with a Tea rose is the ANEMONE ROSE, with large single light pink fls. M.D.G. 1896:345. R.H. 1901:548. Gn. 62, p. 413. G.M. 43:525. W.R. 41.

Section 15. MICROPHYLLÆ. One Asiatic species. Upright spreading shrub, with the straight prickles in pairs: lfts. 7-15; stipules very narrow, with subulate divergent auricles: fls. usually several, with small and quickly caducous bracts; sepals broad, erect and persistent, the outer ones pinnate; carpels only at the bottom of receptacle.

60. *Róxburghii*, Tratt. (*R. microphylla*, Roxbg., not Desf.). Much-branched spreading shrub 6 ft. high, with straight or ascending prickles: lfts. 7-15, elliptic to oblong-elliptic, acute, sharply serrate, glabrous beneath: fls. pale pink, often solitary, 2-2½ in. across, short-pedicelled; sepals and receptacle prickly: fr. depressed-globose, 1½-2 in. across, very prickly. June, July. China. Var. *plena*, Hort. With double fls. B.M. 3490. B.R. 919. W.R. 44. Not quite hardy N. Var. *normalis*, Rehd. & Wilson, is the wild form with single fls. Var. *hirtula*, Rehd. & Wilson (*R. microphylla* var. *hirtula*, Regel). Lfts. elliptic or ovate-oblong, usually acute, pubescent beneath, ½-1 in. long. Japan. B.M. 6548. For a hybrid with *R. rugosa*, see the latter species.

(The figure following the name indicates the section to which the species belongs.) *R. agræsis* Savi (*R. sepium*, Thuill.) (6). Allied to *R. rubiginosa*. Without bristles; pedicels smooth: fls. small, pale pink or whitish. Eu., N. Afr. W.R. 147.—*R. Alberti*, Regel (8). Allied to *R. Willmottii*. Branches slender, recurving: lfts. 5-9, ovate, pubescent beneath, ¼-1¼ in. long: fls. white, 1½ in. across; sepals deciduous; pedicels smooth. Songaria, Turkestan.—*R. amoyensis*, Hance.—*R. microcarpa*.—*R. anemoniflora*, Fort. (1). Half-evergreen climbing shrub: lfts. 3-5, ovate-lanceolate, dark green, glabrous and shining: fls. few, white or slightly pinkish, double, the inner petals narrower and smaller. China. Half-hardy. R.H. 1849:281. W.R. 21.—*R. anserinaefolia*, Boiss., is a variety of *R. Beggeriana*, with silky pubescent lfts.—*R. Ascheroniana*, Graebn. (*R. blanda* × *R. chinensis*). Shrub, to 6 ft., with slender brown branches: prickles hooked: lfts. 5-7: fls. very numerous, small, bright light purple; styles usually exerted. Garden origin. Gt. 51:1504, 1.—*R. banksiopsis*, Baker (8). Branches brown, with subulate prickles, sometimes in pairs: lfts. 7-9, oblong, glabrous, 1 in. or more long: fls. corymbose, red; receptacle glabrous; sepals entire. W. China. W.R. 2:106.—*R. Beggeriana*, Schrank (8). Dense shrub, to 5 ft.: prickles in pairs: lfts. very small and bluish green: fls. corymbose, white; calyx and apex of fr. falling off, leaving the small, globular fr. with an opening at the top. N. Persia to Altai and Songaria. L.T. 5:122. W.R. 54.—*R. bala*, Rehd. & Wilson (8). Allied to *R. Moyesii*. Shrub, to 8 ft.: lfts. 7-9, elliptic or ovate, acutish, glaucescent and glabrous or nearly so beneath, ¼-¾ in. long: fls. solitary, 1½-2 in. broad, pink: fr. ovoid, scarlet, ¾ in. long. N. W. China. Var. *pellens*, Rehd. & Wilson. Fls. pale pink.—*R. britanica*, Koehne (6). Shrub, to 6 ft.: lfts. 7-11, elliptic, glabrous, 1-1½ in. long: fls. 1-2, pale pink changing to white, 3-4 in. across: fr. brown, ovoid. Kurdistan. M.D. 1010, p. 94.—*R. caudata*, Baker (8). Allied to *R. macrophylla*. Much branched: prickles subulate: lfts. 7-9, oblong, glabrous, but hispid on midrib beneath, 1-2 in. long: fls. red, few; pedicels and receptacle bristly; sepals entire: fr. oblong. W. China. W.R. 163.—*R. cerasodrpa*, Rolfe.—*R. Gentiliana*.—*R. chinophylla*, Thory (13). Closely allied to *R. bracteata*. Branches silky pubescent: prickles straight: lfts. elliptic-lanceolate, tomentose beneath: fls. white. India. B.R. 739. Tender.—*R. collina*, Jacq. (5). Allied to *R. alba*, but fls. rose-colored; sepals shorter. Probably hybrid of *R. gallica* with *R. dumetorum*.—*R. coriifolia*, Fries (6). Allied to *R. canina*. Lfts. pubescent beneath; petioles tomentose: fls. pink, short-pedicelled; bracts large; sepals upright after flowering. Eu., W. Asia. W.R. 129. Very variable. Var. *Frœbelii*, Rehd. (*R. canina* var. *Frœbelii*,

Christ). Of vigorous growth: lfts. simply or doubly serrate, bluish green: fls. small, white.—*R. corymbulosa*, Rolfe (8). Upright or scandent, to 6 ft.: lfts. 3-5, ovate-oblong, doubly serrate, puberulous beneath, ¾-1½ in. long: fls. ¾-1 in. across, red with white eye, in dense umbel-like corymbs; pedicels and receptacle glandular-bristly: fr. globose. W. China. B.M. 8566.—*R. Davidii*, Crépin (8). Allied to *R. macrophylla*. Shrub, to 10 ft.: sta. with scattered straight prickles: lfts. 7-11, elliptic to ovate-oblong, serrate, pubescent beneath, 1-2¼ in. long: fls. corymbose, pink, 1½-2 in. across; styles exerted: pedicels like the oblong receptacle glandular-setose, rarely glabrous: fr. scarlet, oblong-ovoid or ovoid, long-necked, ¼-¾ in. long. W. China. Var. *elongata*, Rehd. & Wilson. Lfts. 2-3 in. long: fls. fewer: fr. ¾-1 in. long. W. China.—*R. darwinica*, Pall. (8). Allied to *R. cinnamomea*. Prickles straight and slender; stipules narrow: lfts. smaller, doubly serrate: pedicels longer, glandular: fr. ovate. Manchuria, Dauria, Saghalin.—*R. Ecx*, Aitch. (*R. xanthina*, Auth., not Lindl.) (10). Upright shrub, to 4 ft., with brown branches: prickles numerous, stout, straight, wide-based: lfts. 9-11, oval, obtuse, dentate, glabrous, glandular, ¼-¾ in. long: fls. pale yellow, solitary, short-stalked, 1-1½ in. across: fr. obovoid, ¼-¾ in. long, with reflexed sepals. Turkestan, Afghanistan. B.M. 7666. W.R. 2:94.—*R. elliptica*, Tausch (6). Allied to *R. rubiginosa*: lfts. cuneate-obovate, pubescent beneath: pedicels short, usually not glandular: fls. pinkish or whitish. Eu.—*R. elymantica*, Boiss. & Hausskn. (6). Dwarf shrub, to 3 ft., with prickly zigzag branches: lfts. small, usually 5, glaucescent: fls. 1-3, small, pink: fr. globular, small. N. Persia.—*R. Fedtschenkoana*, Regel (8). Sta. arching, with prickles and bristles: lfts. 7-9, oblong, glabrous or pubescent beneath, ¾-1¼ in.



long: fls. 1-4, white, 1½-2 in. across; pedicels and receptacles hispid. Turkestan. B.M. 7770. W.R. 49.—*R. ferax*, Bieb. (6). Allied to *R. rubiginosa*. Dwarf: lfts. glandular on both sides: pedicels short, not glandular. S. E. Eu., W. Asia. W.R. 154.—*R. filipes*, Rehd. & Wilson (2). Allied to *R. Brunonii*. Sarmentose shrub, to 15 ft., with few hooked prickles: lfts. usually 5-7, oblong-ovate to lanceolate, acuminate, serrate, nearly glabrous, pale beneath, 1½-3 in. long: fls. white, fragrant, about 1 in. across, in large, loose corymbs; pedicels filiform, 1-1½ in. long, glandular: fr. globose, ¼-¾ in. across, scarlet; sepals deciduous. W. China.—*R. floribunda*, Baker.—*R. Gentiliana*.—*R. Freudeniana*, Graebn. (*R. moschata alba hybrida*, Hort. *R. gallica* × *R. moschata*). Vigorous shrub, to 6 ft.: branches with prickles and bristles: lfts. usually 5: fls. white, 1½-2 in. across, very fragrant; style often exerted. Garden origin. Gt. 57, p. 471. G. 25:311.—*R. Frœbelii*, Hort.—*R. coriifolia* var. *Frœbelii*.—*R. Gentiliana*, Léveillé (*R. floribunda*, Baker. *R. cerasodrpa*, Rolfe) (2). Allied to *R. Brunonii*. Sarmentose shrub, to 12 ft., with scattered hooked prickles: lfts. 5, elliptic, abruptly acuminate, serrate, glabrous, glaucescent beneath, 1½-2 in. long: fls. corymbose, white, fragrant, 1-1½ in. across; pedicels and receptacles glandular: fr. dark red, globose, ¾ in. across, with deciduous sepals. Cent. China.—*R. Girdalii*, Crépin (8). Slender-branched shrub, to 6 ft., with straight slender prickles: lfts. usually 7, suborbicular to obovate or elliptic, acute or obtuse, serrate, pubescent, ¼-¾ in. long: fls. solitary or few, pink, 1 in. across: fr. scarlet, ovoid, ¼-¾ in. long. Cent. China. Var. *renulata*, Rehd. & Wilson. Lfts. reticulate beneath, glabrous above.—*R. Girdalii*, Cat. Hesse, is described as having rosy pink fls. with white eye and oblong scarlet fra. It is possibly a synonym of one of the species related to *R. macrophylla*.—*R. glauca*, Vill. (6). Allied to *R. canina*. Lfts. broadly ovate, bluish green: fls. pink; sepals upright after flowering. Eu.—*R. glomerata*, Rehd. & Wilson (2). Sarmentose shrub, to 20 ft., with few scattered hooked prickles: lfts. usually 5-7, oblong or oblong-ovate, short-acuminate, serrulate, rugose above, reticulate beneath and pubescent on the veins, 1¼-4 in. long: fls. white,

fragrant, 1 in. across, in dense corymbs: fr. subglobose, orange-red, about $\frac{1}{2}$ in. across; sepals deciduous. W. China.—*R. glutinosa*, Sibth. & Smith (6). Allied to *R. rubiginosa*. Dwarf, densely prickly: lfts. densely glandular on both sides: fls. small, pink. S. E. Eu., W. Asia. W.R. 150.—*R. gratesima*, Greene (8). Allied to *R. californica*. Lfts. glabrous, bright green and glandular, fragrant, thin. Calif.—*R. hawiana*, Kmet. (6). Allied to *R. pomifera*: flowering shoots usually unarmed: lfts. 5-7, elliptic, pubescent beneath, glabrous above: fls. pink, about 2 in. across: fr. globose, densely bristly. Hungary. W.R. 140.—*R. Heckeliana*, Tratt. (R. Hackeliana, Nym.) (6). Allied to *R. rubiginosa*. Dwarf: lfts. tomentose on both sides: fls. usually solitary, small, pink. S. Eu.—*R. indica*, Linn.—*R. microcarpa*.—*R. inodora*, Fries (*R. agrestis* var. *inodora*, Keller) (6). Allied to *R. rubiginosa*: lfts. 5-7, obovate, not glandular above: fls. white or pinkish, 1-1½ in. across: fr. ovoid, bright red. Eu. W.R. 151.—*R. involuta*, Roxbg.—*R. clinophylla*.—*R. involuta*, Smith (6). Probably hybrid of *R. spinosissima* and *R. tomentosa*. Lfts. doubly glandular-serrate, tomentose beneath: fls. whitish. W.R. 96.—*R. Jackii*, Rehd. (R. Kelleri, Baker, not Dalla Torre & Sarnth.) (2). Allied to *R. moschata*: low procumbent shrub, with ascending branches: lfts. 7-9, elliptic or elliptic-oblong, glabrous, 1½-2½ in. long: fls. in corymbs, white, 1½ in. across; sepals ovate, abruptly caudate: fr. ovoid, red, ½ in. long. Korea. Hardy.—*R. Jundzili*, Bess. (6). Allied to *R. canina* but resembling also *R. gallica*. Upright shrub, with straight spines: lfts. almost glabrous, doubly glandular-serrate, rather large: fls. large, pink; fr. subglobose. Eu., W. Asia. W.R. 149.—*R. Kelleri*, Baker—*R. Jackii*.—*R. laza*, Retz. (8). Upright shrub, with hooked prickles in pairs: lfts. 7-9, small, light green: fls. small, white: fr. oblong-ovate, small. Turkestan to Songaria and Altai. W.R. 53.—*R. laza*, Lindl.—*R. lucida*.—*R. laza*, Hort.—*R. corifolia* var. *Froebelii*.—*R. Leichenaultii*, Wight & Arn. (*R. moschata* var. *Leichenaultii*, Crépín) (2). Similar to *R. Brunonii*, but fls. larger, in few-fld. corymbs; pedicels and receptacle glandular-hispid. India. W.R. 15.—*R. longicuspis*, Bertol. (R. Snowdonii, Hemsl. R. Willmottiana, Léveillé. R. lucens, Rolfe). Half-evergreen scandent bush, to 20 ft., with hooked prickles: lfts. usually 7, elliptic-ovate to oblong-lanceolate, acuminate, glabrous, lustrous, 1-3 in. long: fls. corymbose, white, 1½ in. across; petals silky outside; pedicels about 1 in. long: fr. ovoid, ½ in. long, scarlet or orange-red. W. China. Himalayas. Tender.—*R. lucens*, Rolfe—*R. longicuspis*.—*R. Lucia*, Franch. & Roehrb. (2). Allied to *R. Wichuraiana*. Habit more upright: lfts. usually 7, narrower and thinner: fls. smaller. Japan.—*R. Lyellii*, Lindl. Probably hybrid of *R. moschata* and *R. clinophylla*. Climbing: lfts. usually 7, oblong, shining: fls. corymbose, large, white, single or double. Intro. from Nepal.—*R. Macdonii*, Greene (8). Allied to *R. Woodii*: low shrub, with rather stout, deflexed prickles: lfts. 9-11, obovate to obovate-oblong, sharply serrate, except at the cuneate base, pubescent beneath, ½-¾ in. long: stipules glandular: fls. small, pale pink: fr. depressed-globose. Assiniboia to Wyo.—*R. macrantha*, Desportes (*R. canina* × *R. gallica*). Shrub with uniform hooked prickles: lfts. 5-7, chartaceous, ovate to ovate-oblong, pubescent beneath, 1-1½ in. long: fls. few, 3 in. across, light pink. Spontaneous in S. France. W.R. 134.—*R. Mareyana*, Boullu (*R. gallica* × *R. tomentosa*). Low, to 2, rarely to 4 ft., prickly and bristly: lfts. 5-7, broadly oval, pubescent on both sides, 1-2 in. long: fls. long-stalked, pink to light purple, 2½-3 in. across. Spontaneous in S. France. W.R. 112.—*R. Maria-Graebneri*, Aschers. (*R. carolina* × *R. virginiana*). Shrub, to 5 ft., with slightly recurved prickles: lfts. 7-9, elliptic: fls. few, pink; fr. subglobose: blooms almost all summer and very handsome in fall with orange and red foliage, red frs. and pink fls. Garden origin. Gt. 51:1504, 4.—*R. micrantha*, Smith (6). Allied to *R. rubiginosa*. With hooked prickles, without bristles: lfts. slightly pubescent beneath: fls. pale pink, small; styles slightly exserted, glabrous. Eu., N. Afr., W. Asia.—*R. microcarpa*, Lindl. (*R. indica*, Linn., partly, not Lindl. *R. sorbiflora*, Focke) (4). Branches slender, with scattered, hooked prickles: lfts. 3-7, elliptic to ovate-lanceolate, glabrous, 1½-2½ in. long: stipules almost free: fls. corymbose, small, white: fr. small, globose; sepals deciduous. China. G.C. III. 37:227.—*R. microcarpa*, Hort.—*R. multiflora*.—*R. montana*, Chaix (6). Allied to *R. canina*. Of vigorous growth, with strong spines: lfts. broader, tinged reddish: fls. pink; pedicels and receptacle glandular-hispid. S. Eu., N. Afr.—*R. multibracteata*, Hemsl. & Wilson (*R. reducta*, Baker) (8). Shrub, to 6 ft., with straight paired

prickles: lfts. 7-9, broadly oval, glabrous, ¼-½ in. long: fls. pink, 1½ in. across, corymbose with numerous crowded bracts, sometimes few or solitary; styles exserted: fr. ovoid, ¼-½ in. long, orange-red; sepals persistent. W. China. W.R. 158 (form with few-fld. infl.).—*R. Murielae*, Rehd. & Wilson (8). Slender-branched shrub, to 8 ft., with bristles and slender prickles: lfts. 9-15, elliptic to elliptic-oblong, rarely oval, acutish, serrate, glabrous, except the pubescent midrib beneath, ½-¾ in. long: fls. white, about 1 in. across, in 3-7-fld. corymbs; pedicels slender, ¾-1½ in. long: fr. ellipsoid, orange-red, ½-¾ in. long. W. China.—*R. orbicularis*, Baker (8). Sta. slender, with subulate prickles in pairs: lfts. 5-7, orbicular, simply serrate, glabrous, ½ in. long: fls. 1-3, 1½ in. across, white. S. W. China.—*R. orientalis*, Dup. (6). Allied to *R. rubiginosa*. Dwarf: prickles slender, subulate: lfts. 5-7, simply serrate, pubescent on both sides: fls. pink, solitary, short-pedicelled. W. Asia.—*R. persiana*, Rolfe (*R. macrophylla* var. *gracilis* and var. *acicularis*, Vilm.) (8). Upright shrub, with densely bristly sta.: lfts. 5-9, elliptic to elliptic-ovate, serrate, puberulous beneath, ¼-2 in. long: fls. deep pink, 1 in. across, in large panicles; sepals entire; pedicels and receptacle glabrous. W. China. J.H.S. 27:487, 488.—*R. phœnicea*, Boiss. (2). Allied to *R. moschata*. Lfts. usually 5, obtuse or acute: corymbs usually many-fld., pyramidal: styles glabrous. Asia Minor.—*R. Prudii*, Hemsl. (8). Slender-branched shrub, to 8 ft., with slender prickles and numerous bristles: lfts. 7-15, elliptic, obtusish, serrate, pubescent on the veins beneath, ¼-¾ in. long: fls. 1-3, pink, ¾ in. across: fr. subglobose to ovoid, scarlet, ¼-¾ in. long; calyx persistent. W. China.—*R. reducta*, Baker—*R. multibracteata*.—*R. Rubus*, Léveillé & Vaniot (2). Scandent bush, to 20 ft., with small hooked prickles: lfts. usually 5, ovate-elliptic to ovate, abruptly acuminate, sharply or coarsely serrate, pubescent beneath, rarely nearly glabrous, 1½-2½ in. long: fls. in dense corymbs, white, fragrant, 1-1½ in. across; pedicels ¼-¾ in. long, glandular: fr. subglobose, dark scarlet, about ½ in. across. Cent. China.—*R. sancta*, Rich. (5). Low shrub, with unequal scattered hooked prickles: lfts. 5-7, elliptic to ovate-oblong, crenate, rugose, pubescent beneath: fls. few, large, pink, on setose pedicels. Abyssinia. W.R. 113.—*R. saturdia*, Baker (8). Shrub, to 8 ft., unarmed or with few small prickles: lfts. usually 7, ovate to ovate-lanceolate, acute or short-acuminate, sharply serrate, pale or somewhat glaucous beneath, pubescent on the veins or sometimes nearly glabrous, 1-2½ in. long: fls. solitary, dark red, about 2 in. across; anthers purple: pedicels glabrous, ¼-1 in. long: fr. globose-ovoid, ¾ in. long, coral-red; calyx persistent. Cent. China.—*R. Scharneckiana*, Graebn. (*R. californica* × *R. nitida*). Shrub, to 3 ft., with slender, often procumbent and ascending sta.; prickles slender, in pairs, below often mixed with bristles: lfts. 7-9, elliptic-oblong to oblong, cuneate: fls. 1-5, rose-purple. Garden origin. Gt. 51:1504, 2.—*R. sepium*, Thuill.—*R. agrestis*.—*R. Seraphinii*, Viv. (6). Shrub, 1-3 ft., with copious, unequal, partly hooked prickles: lfts. 5-7, orbicular-ovate, doubly serrate, glandular beneath, ¼-¾ in. long: fls. solitary, very short-stalked, 1 in. across, pink: fr. globose-ovoid, with reflexed, finally deciduous sepals. Medit. region. W.R. 153.—*R. Seraphinii*, Guss.—*R. sicula*.—*R. serotina*, Rolfe (8). Shrub to 5 ft.; branches glaucous, with straight slender prickles in pairs: lfts. 7-11, oval-oblong to narrow-oblong, serrate, glabrous, ¼-¾ in. long: fls. solitary on short branchlets, rose or rose-purple, 2-3½ in. across; sepals caudate, entire. W. China. B.M. 8473. G.C. III. 54:166. W.R. 2:153.—Very handsome graceful rose; has proved hardy at the Arnold Arboretum.—*R. sicula*, Tratt. (*R. Seraphinii*, Guss., not Viv.) (6). Low, ½-2 ft., with equal, slender, nearly straight prickles: lfts. 5-9, broadly elliptic to orbicular, glandular beneath, ¼-¾ in. long: fls. solitary, rarely to 4, short-stalked, deep red to whitish, 1-1½ in. across: fr. small, globose, with upright sepals. Medit. region. B.M. 7761 and G.W. 8, p. 17 (as *R. Seraphinii*).—*R. Sinoulsonii*, Hemsl.—*R. longicuspis*.—*R. sonomensis*, Greene (8). Allied to *R. californica*. Low shrub, to 1 ft., with straight prickles: lfts. broadly ovate, doubly glandular-serrate: fls. small, in dense corymbs. Calif.—*R. sorbiflora*, Focke—*R. microcarpa*.—*R. Soulieana*, Crépin (2). Upright spreading shrub, to 12 ft., with scattered hooked prickles: lfts. usually 7, oval to ovate-oblong, acute, finely serrate, glabrous, about 1 in. long: fls. corymbose, white, 1½ in. across; sepals ovate: fr. ovoid or subglobose, ½-¾ in. long, orange-red. W. China. B.M. 8158. W.R. 1:18. G. 77, p. 511.—*R. spithamea*, Wats. (8). Allied to *R. californica*. Sta. usually not over ½ ft. high, sparingly branched: lfts. doubly glandu-



3459. *Rosa laevigata*. Run wild in the South and known as Cherokee rose. No. 59.

lar-serrate; fls. usually solitary. Calif.—*R. stylaea*, Desv. (*R. systyla*, Bastard) (6). Shrub with long arching prickly branches; fls. 5-7, ovate-oblong, pubescent beneath, $\frac{3}{4}$ -2 in. long; fls. few, white or light pink, $1\frac{1}{2}$ -2 in. across; styles connate into an exerted column. W. Eu. Red. Ros. (1:5, 2). W.R. 14.—*R. Sweginowii*, Koehne (8). Shrub with large compressed prickles; fls. usually 9, ovate to ovate-oblong, doubly serrate, pubescent beneath, $1\frac{1}{2}$ -2 in. long; fls. 1-3, pink, $1\frac{1}{2}$ in. across; sepals nearly entire; pedicels and receptacles glandular-hispid; fr. oblong, 1 in. long. W. China. M.D. 1910, p. 96.—*R. systyla*, Bastard=*R. stylosa*.—*R. tomentosa*, Smith (6). Allied to *R. villosa*. Sts. slender, often arching; prickles often slightly curved; fls. smaller, grayish green; fls. pale rose, on longer pedicels; fr. smaller, with the sepals upright spreading, caducous at maturity. Eu. W.R. 139. Gn. 77, p. 511.—*R. trachyphylla*, Rau=*R. Jundsiillii*.—*R. Vorbergii*, Graebn. (*R. foetida* \times *R. spinosissima*). Shrub, to 3 ft.; lvs. similar to those of *R. foetida*; fls. white with a delicate flushing of yellow, 2 in. across, early. Garden origin. Gn. 79, p. 323 (as *R. Vorbergii*).—*R. Webbiana*, Wall. (8). Erect shrub, with prickly sts.; fls. 5-9, very small, orbicular or oblong, usually glabrous; fls. mostly solitary, pink, large; fr. ovoid. Himalayas to Afghanistan and Turkestan. W.R. 76.—*R. Willmottiana*, Léveillé=*R. longicauspis*.—*R. zanthina*, Lindl. (10). Upright shrub, to 10 ft. with brown branches; prickles straight, stout; fls. 7-11, oval or elliptic, obtuse, dentate, pubescent beneath, or sometimes glabrous, not glandular, $\frac{3}{4}$ -1 in. long; fls. solitary, short-stalked, yellow, double, $1\frac{1}{2}$ in. across. N. China, Korea. Var. *normalis*, Rehd. & Wilson, is the single-fl. wild form.—*R. zanthina*, Auth.—*R. Ecce*.

ALFRED REHDER.

ROSCHERIA (name unexplained). *Palmaceæ*, tribe *Arècæ*. A genus of one species, a palm from the Seychelles, allied to *Hyophorbe*.

Slender, erect, spiny at the nodes; lvs. terminal, long-petioled, at first 2-fid, later unequally pinnatisect; segms. numerous, linear-lanceolate, 2-fid at the apex, the numerous nerves scaly beneath; petiole spineless, somewhat 3-sided, concave above; sheath long, prickly; spadix 2-6 ft. long; peduncle long, slender, compressed; branches slender, rather simple, divaricate; spathes many, entire, narrowed, compressed, naked, the 2 lower ones persistent, the upper deciduous; fls. pale; fr. fusiform, small, black. *Roscheria* is little known in Amer. and may not now be in the trade. Cult in greenhouse with plenty of moisture. Prop. by imported seeds, obtainable only rarely. Of little general horticultural importance, but the plant is likely to be seen in choice amateur collections.

melanochætes, Wendl. (*Versaffeltia melanochætes*, Wendl.). Trunk 15-25 ft. high, 2-3 in. diam., with many aerial roots, and when young with a ring of spines below each lf.-scar; lvs. $4\frac{1}{2}$ -7 ft. long; petiole $1\frac{1}{2}$ -2 $\frac{1}{2}$ ft. long, smooth, with a pale band running from the top of the sheath down the back of the petiole; sheath $1\frac{1}{2}$ -2 $\frac{1}{2}$ ft. long, with a few fine black spines; lf.-blade pale green, 3-5 ft. long, 2-3 ft. broad, entire when young, unequally pinnate; segms. 1-1 $\frac{1}{2}$ ft. long, 2-fid at the apex, clothed beneath with peltate scales. Seychelles. I.H. 18:54.

JARED G. SMITH.
N. TAYLOR.†

ROSCOEIA (named after Wm. Roscoe, 1753-1831). *Zingiberaceæ*. Half-hardy perennial herbs often grown in the greenhouse, but also used for border planting.

Roots thick, fleshy, and fascicled; lvs. lanceolate or oblong; infl. in terminal spikes; bracts persistent, 1-fl.; fls. purple, blue, or yellow; calyx long, tubular, slit down one side; corolla-tube slender, lateral segms. spreading, upper broad, cucullate, erect; lateral staminoides oblancoate, petaloid, erect, lip large, cuneate, deflexed, 2-cleft or emarginate; ovary 3-celled; caps. cylindric or clavate.—About 15 species, Himalaya region and China. Monographed by Schumann in Engler's *Pflanzenreich*, hft. 20 (vol. IV:46). *Roscocae* thrive in light turfy loam and are prop. by division. *R. purpurea* is the species best known in cultivation.

alpina, Royle. About 4-6 in. high; lvs. 3-4 in. long, not fully developed at flowering-time, sessile, oblong-lanceolate; spike sessile, 1-2-fl.; calyx-tube green, 1 in. or more long, slit nearly to base; corolla-tube white, 1 in. long; limb dark purple, the upper segm. orbicular; staminoid oblong-spatulate, lip deeply 2-cleft. Himalayas and Burma.

cauleoides, Gagnep; also spelled *caulioides*. About 9-12 in. high; roots fleshy, almost tubercous, lvs. remind-

ing one of an iris and springing from the base; scapes 6-7-fl.; fls. pale primrose-yellow, borne singly in the axils of sheathing bracts. China. G. 36:669. Gn. 77, p. 275; 78:159.—The roots should be planted 4-5 in. below the surface in sandy loam.

purpurea, Smith. Fig. 3460. About 6-12 in. high; sts. with 5-6 sessile, lanceolate lvs.; fls. few, in a sessile spike; calyx green, $1\frac{1}{2}$ in. long, slit deeply down one side as the fl. expands; corolla-tube rather dilated upward; limb purple, rarely pale lilac or white, upper

3460. *Roscoeia purpurea*. ($\times\frac{1}{4}$)

segm. about 1 in., very cucullate, lower lanceolate, decurved; staminoid oblancoate-unguiculate; caps. cylindric. Himalayas, Assam, and Burma. B.M. 4630. B.R. 26:61. L.B.C. 15:1404. G.C. III. 8:191. Gn. 78:159. G.W. 14, p. 370. J.F. 3:230.—A variable species, the hardiest of the genus. Var. *sikkimensis*, Hort. (*R. sikkimensis*, Hort.), is said to differ from the type in being epiphytic, in its roots and sts., and its more numerous fls. which are a different shade of purple. Himalayas. Gn. 78:159.

F. TRACY HUBBARD.

ROSE (see also *Rosa*). The queen of flowers; woody plants, some of them distinctly shrubby, many forms much developed horticulturally, all grown for the beautiful and mostly fragrant flowers in white, yellow, and shades of red. See also *Rosa*.

It has been said that the garden rose does not thrive in North America as it does in Europe; but however true this may have been, it scarcely holds today. The success of the rose in this country is very largely a question of the selection of adaptable varieties. These varieties are mostly the compounds of various types and species. In most garden roses it is now impossible to trace the original species with accuracy. For horticultural purposes, a purely botanical classification is of minor consequence, although, in the main, the leading garden-groups follow old specific lines. For a garden classification that follows botanical lines closely, see Baker in Gardener's Chronicle, II. 24, p. 199 (1885). It is essential to success, however, that the intending rose-grower have a clear understanding of the main horticultural groups and the kinds of varieties in them, and this information is provided in Barron's article, beginning on page 3001.

Following are the equivalents of some of the common names of roses:

Ayrshire.....	<i>R. arvensis</i> var. <i>capreolata</i> .
Banks Rose.....	<i>R. Banksia</i> .
Bengal.....	<i>R. chinensis</i> .
Bourbon.....	<i>R. barbonica</i> .
Champney.....	<i>R. Noisettiana</i> .
Cherokee.....	<i>R. laevigata</i> .
Cinnamon.....	<i>R. cinnamomca</i> .
Damask.....	<i>R. damascena</i> .
Dog.....	<i>R. canina</i> .
Eglantine.....	<i>R. rubiginosa</i> .
Macartney.....	<i>R. bracteata</i> .
Memorial.....	<i>R. Wichuraiana</i> .
Moss.....	<i>R. gallica</i> var. <i>muscosa</i> .
Musk.....	<i>R. moschata</i> .
Noisette.....	<i>R. Noisettiana</i> .
Prairie.....	<i>R. setigera</i> .
Provence.....	<i>R. gallica</i> .
Scotch.....	<i>R. spinosissima</i> .
Sweetbrier.....	<i>R. rubiginosa</i> .
Tea.....	<i>R. odorata</i> .

When one speaks of roses, the hearer is likely to think only of the large improved kinds of the gardens; and yet there are more than one hundred well-recognized species-forms of *Rosa*, while only a dozen or so have entered largely into the horticultural forms. The systematic account beginning on page 2981 describes sixty species, and many more are entered in the supplementary list at its conclusion. The results of domestication are marvelous, and yet the real breeding of roses is little more than begun, and it confounds the imagination if one contemplates what may appear when endless new combinations are made with the many species that are yet little modified by man. The beginnings in this endeavor by persons in this country and elsewhere, indicate a rich field for useful experiment.

These other species of *Rosa*, aside from the domesticated forms, are of interest and merit largely for land-

scape planting. Usually we do not think of roses as "shrubby" but rather as "flowers;" yet *Rosa rugosa* is a good landscape subject, and the same is true of *R. setigera*, *R. multiflora*, *R. laevigata*, and many other species. The lists and suggestions by Rehder, on page 2982, are valuable in this connection. Some of the native wild roses are most attractive in their natural setting, not alone in flowers but in foliage, color of stems, fruit, and general habit; and if the grounds include a suitable area, these plants may well be transferred in quantity. In half-wild and informal borders, on banks, along streams and the margins of woods, many of the roses are admirable. The usual horticultural roses are of little merit in landscape work, because they do not supply sufficient foliage and they lack strong shrubby characteristics; and this fact has no doubt obscured the merits of the wild single roses as material for planting.

The highly improved roses are essentially flower-garden subjects, and they produce better bloom when grown by themselves in regular areas, plantations or beds, where they may receive tillage and such other treatment and care as are specially adapted to them. The preferable location is in the private parts of the place, at the side or rear, and well removed from tall buildings and overhanging trees. They should be given ample space, good soil, and liberal fertilizing, as one would provide these requisites for strawberries, bush-fruits or tomatoes.

The value of the rose product is particularly difficult to estimate. A census-accounting could assemble figures for the nursery stock, the glass devoted to rose-culture, and the value of roses sold by commercial establishments; but the greatest value of the rose is the unmeasurable satisfaction that it returns in thousands of homes and the ministry that it renders to millions of persons.

The literature of the rose is voluminous. The American book writings on the subject are listed on page 1552, Vol. III. For a list of rose books in all languages, see "Bibliografía de la Rosa," by Vergara, Madrid, 1892.

Rose organizations.

The American Rose Society was organized in New York, March 13, 1899, "to increase the general interest in the cultivation and improve the standard of excellence of the rose for all the people," to organize a system of exhibitions, and otherwise "to foster, stimulate, and increase the production in every possible way of improved varieties of the rose, suitable to our American climate and requirements." The Society is a clearing-house for those interested in roses.

Including at first primarily so-called commercial rose-growers—those who grow roses the year round for cut-flowers—the Society has gradually broadened until a considerable number of interested and capable amateur rose-growers are included. Intensive consideration for the rose is fostered by the exhibitions that the Society either conducts or over parts of which it exercises authoritative supervision. For example, four so-called national flower shows, held in Chicago, New York, Boston, and Philadelphia, have had as a prominent attraction notable displays of roses forced into bloom in the early spring, usually offered in competition for the prizes gathered under the leadership of the Society. Inasmuch as these displays have included many of the better climbers and garden roses, large numbers of persons are thereby brought into contact with these advances in rose-culture.

Rose test-gardens have been established under the supervision of The American Rose Society in several places, including, for example, Hartford (Conn.), Washington, Minneapolis, and at Cornell University, Ithaca, N. Y. In these gardens no less than five plants of certain varieties are grown



3461. American Pillar rose.—One of the Multiflora group. (× 1/4)



XCIX. Rose.—White, Bride; pink, Bridesmaid.



under comparable conditions, and committees of the Society make an annual inspection at the time of bloom. The rose test-garden in Hartford, in connection with the well-known and beautiful municipal garden planted in 1904 by Theodore Wirth, has proved a wholesome attraction to the more than 115,000 persons who have annually visited it. The superintendent of the Hartford park system estimates that the area included in the rose-garden attracts visitors at the rate of 85,000 persons a year, thus increasing the use of a park system.

The Society maintains a bureau of registration for new roses, provides a scale of points for judging both blooms and plants, and awards medals and certificates for new roses. Its membership includes three classes—life, active, and associate—the latter relation being open only to amateur rose-growers. In 1916, The American Rose Society began the publication of The American Rose Annual, under the editorship of J. Horace McFarland.

Under the leadership of E. M. Mills, of Syracuse, New York, an organization was formed in that city under the title of the Syracuse Rose Society, for the purpose of stimulating local interest in rose-growing. The ideal proposed by Dr. Mills is noted in the following extract from his article in the 1916 American Rose Annual: "It is far more important that 500 people in a city have rose-gardens with from twenty-five to a few hundred bushes in each of them than that there should be only a few large show gardens." Other societies have been formed in the Pacific Northwest directly to promote rose-growing, and various garden clubs and local societies have affiliated with The American Rose Society under its rules. There are a number of affiliated interests. Any horticultural society in the United States or Canada holding an annual exhibition of roses may affiliate with The American Rose Society, and receive medals for the exhibitors.

The present assembly on the rose, aside from the systematic account of Rosa, pages 2981 to 2999, comprises the following articles:

	Page
Horticultural classification of roses (Barron)	3001
Propagation of roses (Watson)	3004
Roses for the amateur (Huey, Beal)	3006
Outdoor roses for the mid-continental region (Irish)	3010
Roses in California (Braunton)	3012
The cultivation of roses under glass (Pierson)	3014
Rose insects (Crosby and Leonard)	3018
Rose diseases (Massey)	3019

L. H. B.

Horticultural classification of roses.

The garden classification of roses presents considerable difficulty, as the several groups have been so much mixed that the original characteristics of each overlap at nearly all points. This is particularly true of the Perpetuals, of which any close classification is impossible. The difficulties increase as one advances. Certain clear-cut characters may be taken to mark given distinct groups in the summer roses, with which the horticulturist has not busied himself so much. Nearly all of these characters are reproduced in the Perpetuals, and, being blended, give rise to endless confusion; thus the following scheme is merely suggestive and should be studied in comparison with the botanical classification (see page 2983).

American rose-culture, so far as garden varieties are concerned, can hardly be said to have established itself as yet. Our growers are today striving to overcome the short-lived character of the blooms, so as to secure in our gardens something of the rose beauty of Europe. The Wichuraiana, Rugosa, and Multiflora roses, combined with our native species and blended again with the best representatives of the garden-groups already grown, with the admixture of some of the newer species from western China, seem to offer the solution. The

beginning has already been made. The hot sun and trying climatic conditions of our summers are fatal to the full beauties of the roses of France and England. The flower is developed so quickly that it has no opportunity to "build" itself, and once developed it fades as rapidly. What has been accomplished for the other florists' flowers remains yet to be accomplished for the rose, and the American rose of the future must be developed to suit the circumstances in the same way that the American carnation has been produced.

CLASS I. SUMMER-FLOWERING ROSES, BLOOMING MOSTLY ONCE ONLY.

- A. *Large-flowered (double).*
 - B. *Growth branching or pendulous: leaf wrinkled...*
 - 1. *Provence*
Moss
Pompon
Sulphurea
 - BB. *Growth firm and robust: leaf downy.....*
 - 2. *Damask and French*
Hybrid French
Hybrid Provence
Hybrid Bourbon
Hybrid China
 - BBB. *Growth free: leaf whitish above, spinelless...*
 - 3. *Alba*
 - AA. *Small-flowered (single and double).*
 - B. *Growth climbing: fls. produced singly.....*
 - 4. *Ayrshire*
 - BB. *Growth short-jointed, generally, except in Alpine and Prairie...*
 - 5. *Briers*
Austrian
Scotch
Sweet
Penzance
Prairie
Alpine
 - BBB. *Growth climbing or rambling: fls. in clusters...*
 - 6. *Multiflora*
Baby Ramblers.
 - BBBB. *Growth free: foliage persistent (more or less), shiny.....*
 - 7. *Evergreen*
Sempervirens
Wichuraiana
Cherokee
Banksian
 - BBBBB. *Growth free: foliage wrinkled.....*
 - 8. *Pompon*

CLASS II. SUMMER- AND AUTUMN-FLOWERING ROSES, BLOOMING MORE OR LESS CONTINUOUSLY.

- A. *Large-flowered.*
 - B. *Foliage very rough.....*
 - 9. *Hybrid Perpetual*
 - 10. *Hybrid Tea*
 - 11. *Moss*
 - BB. *Foliage rough.....*
 - 12. *Bourbon*
 - 13. *Bourbon Perpetual*
 - BBB. *Foliage smooth.....*
 - 14. *China*
Tea
Lawrenceana (Fairy)
 - BBBB. *Foliage smooth, very shiny and vigorous...*
 - 15. *Pernetiana*
 - AA. *Smaller-flowered.*
 - B. *Foliage deciduous.*
 - c. *Habit climbing.....*
 - 16. *Musk*
Noisette
 - 17. *Ayrshire*
 - 18. *Perpetual Multifloras*
Wichuraiana Hybrids
 - cc *Habit dwarf, bushy...*
 - 19. *Perpetual Briers*
Rugosa
Lucida
Microphylla
Berberidifolia
Scotch
 - BB. *Foliage more or less persistent.....*
 - 20. *Evergreen*
Macartney
Wichuraiana

Garden-group 1. *Provence*. Fragrant; branching or pendulous: fls. generally globular: foliage bold, broad, wrinkled, deeply serrate: prickles uncertain; sometimes fine and straight, sometimes coarse and hooked. Rich soil. Prune closely unless very vigorous. Types are Moss rose, a crested form of the Provence (Fig. 3442).



3462. American Beauty, one of the most popular roses in America. One of the Hybrid Perpetual class. The picture shows a specimen grown in the open. (X 1/2)

Pompon, a dwarf group; cupped flowers. See also No. 8. Sulphurea, an undesirable yellow form of difficult cultivation.

Garden-group 2. *The Damask and French*. Damask roses are fragrant; growth robust; spinous: lvs. light green, downy, coriaceous. Hardy: free-flowering: scent destroyed on drying.

French roses: Fragrant (moderately): more upright and compact in growth than the Provence: prickles smaller and fewer: fls. generally flat. Very hardy, growing in any soil; petals bleach in strong sunlight; makes abundance of wood, which should be thinned out; perfume develops in the dried petals.

Hybrid French or Hybrid Provence, a less robust group with smoother, short-jointed wood and generally light-colored flowers. Type Princess Clemantine. Other subdivisions include hybrids with nearly all of the Perpetual group. Madame Plantier is a Hybrid Noisette. Coupe d'Hebe is a Hybrid Bourbon.

Hybrid China (China \times French and Provence, partaking more of those parents). Growth more diffuse than the French rose: foliage smooth, shining, and remains on the bush late in the year; thorns numerous and strong. Vigorous of growth; very hardy, and not generally well adapted to poor soil; requires but little pruning.

Garden-group 3. *Alba, or white roses*. A very distinct group: all light-colored flowers of moderate size: leaf whitish above, deep green below: spineless (some hybrids with other groups are very thorny), of free growth; prune closely. Type, Felecite Parmentier and Maiden's Blush.

Garden-group 4. *Ayrshire*. Climbing roses; very hardy: slender shoots suitable for trellises and trunks of trees: fls. produced singly. Useful for pot cultivation when trained over a frame; fls. vary from white to deep crimson. Type, Queen of the Belgians, Dundee Rambler. Ruga is a hybrid between this group and one of the Teas; fragrant.

Garden-group 5. *Briers*. Under this heading may be grouped most of the well-defined types of garden roses, mostly small-flowered and which do not readily respond to high cultivation. They are more useful as flowering shrubs in the garden than for cut-flowers. The blooms are generally short-lived.

Austrian or Yellow Briers. Small leaflets: solitary flowers: bark chocolate-brown. Very hardy, but require free air and dry soil; will stand very little pruning, as it produces flowers from the upper ends of the old wood. Types, Harrison's Yellow, Austrian Copper, and Persian Yellow.

Scotch or Spiny. This group is well recognized by its excessive spininess; compact low bushes, flowering abundantly and early: flowers small, double. Multiply by underground suckers; fragrant. One hybrid of this group, Stanwell, is a Perpetual.

Sweetbriar. Distinguished by the fragrance of its leaves: the fruits are also decorative: foliage small: flowers light-colored and not of much merit.

Lord Penzance Briers. This is a group of hybrids of *R. rubiginosa* (the Sweetbrier), and the older large-flowered varieties, especially Bourbon and Damask. The results are hardly distributed in America as yet; a few are to be found in select collections. Generally speaking they may be described as very greatly improved Sweetbriers. Brenda is particularly desirable for its fruit.

Prairie rose (*R. setigera*). A native species; promises under cultivation to develop some valuable acquisitions, especially in hybridization with other groups: Type, Baltimore Belle (Fig. 3439).

Alpine or Boursault. Native of the Swiss Alps; semi-pendulous, long, flexible, smooth shoots: flowers in large clusters; mostly purple or crimson flowers. Good for pillars; very hardy; especially suitable for shady places; should be well thinned in pruning, but the flowering wood left alone: type Amadis. Produced by crossing Teas and *R. alpina*.

Garden-group 6. *Multiflora*. The Multiflora group divides itself naturally into the Multiflora true and Baby Perpetual Ramblers. *R. multiflora*, the parent type, is characteristic of the varieties here, the flowers being produced in large corymbs and continuing over a comparatively long time. These varieties are useful as pillar and trellis roses and respond to high cultivation. In pruning, remove only the old canes, leaving the young new growth to carry flowers next year. The American Pillar rose belongs here (Fig. 3461). This group is particularly well adapted to the wild-garden. The name Polyantha, sometimes applied to these roses, should be dropped to avoid confusion. The *Rosa polyantha* of botanists is a synonym of *R. multiflora* (p. 2985), but the Polyanthas of horticulturists are hybrids of *R. multiflora* with *R. chinensis* or Hybrid Perpetuals; they are low bushy plants, first described as Polyantha varieties by Carrière in Revue Horticole, 1884.

Garden-group 7. *Evergreen*. The so-called Evergreen roses hold their foliage until very late in the year and in hybridization appear likely to yield varieties which are practically evergreen.

Sempervirens, useful as pillar roses, producing flowers in corymbs: very hardy: vigorous growth: free bloomer: requires considerable thinning in pruning. Types, *Felicite perpetuelle*.

Wichuraiana (Fig. 3440), most popular of all the rampant roses: very hardy, growing in any soil: this promises to be the basis of a very valuable race of American roses: flowers in the type white. Hybrids have been raised from Hybrid Perpetual and Tea varieties giving large flowers, scented; such are *Gardenia* and *Jersey Beauty*. Many hybridists have worked on this species, and the past few years have thoroughly made good the early promise of remarkable developments.

Cherokee (*Rosa laevigata*) of the southern states can be grown satisfactorily away from its native regions only in a greenhouse. (Figs. 3458, 3459.)

The *Banksian* (*Rosa Banksia*). Two varieties of this are known, the yellow and the white. Requires greenhouse treatment: evergreen: needs very little pruning, merely shortening the shoots that have bloomed. Yellow variety scentless, white variety possessing the odor of violets: flowers are produced in graceful drooping clusters.

Garden-group 8. *Pompon*. A small-flowered Provence rose. See No. 1.

Garden-group 9. *Hybrid Perpetual*, or *Hybrid Remontant*. A large and comprehensive group of much-mixed origin. The mixture with other groups has become so involved as to render separation practically impossible. The characteristics may be described as stiff, upright growth, sometimes inclined to pendulous: flowers of all types: foliage dull green, wrinkled, not shiny: embracing generally the characteristics of the Provence, Damask, French, and the Chinese groups: flowers large, inclined to flat, generally of dark colors. By far the largest and most comprehensive division. (Figs. 3462, 3463.)

Garden-group 10. *Hybrid Teas* form a section of the Hybrid Perpetual group crossed back on to the Tea-scented China, gradually losing all identity. They differ from the pure Hybrid Perpetuals by having foliage of a deeper green and less wrinkled. Some of the best forcing roses are in this group, which promises the greatest development for American rosarians; Robert Scott is a type of this class and is raised from *Merveille de Lyon*, Hybrid Perpetual, and *Belle Siebrecht*, Hybrid Tea. The *La France* type belongs here. (Fig. 3464.)

Garden-group 11. *Moss*. A perpetual-flowering group of the Provence. See Summer Roses and Fig. 3442.

Garden-group 12. *Bourbon*. Dwarf and compact growth, with rounded, more or less shining leaflets: very floriferous: brilliant colors: good outline: in perfection late in the season: requires close pruning. Type, *Hermosa* (or *Armosa*).

Garden-group 13. *Bourbon Perpetual*. Very floriferous: flowers moderate-sized, well formed, in clusters. Type, *Madame Isaac Pereire*.

Garden-group 14. *China* (*Rosa chinensis*). The China or Monthly rose is characterized by its positively perpetual manner of flower. Its blooms become much darkened in color from the action of the sun's rays: flowers small and irregular in shape. Somewhat tender.

The Tea-scented China or Tea Rose (Fig. 3465), *Rosa odorata*, is an allied species. It has large thick petals, with the characteristic tea scent: flowers generally light-colored, pink and creamy yellow: growth free; the best for forcing. The group has been hybridized with all other sections and the Tea influence is seen throughout the rose family. Some of the varieties are climbing. Type *Bon Silene* and *Homer*.

Lawrenceana. Dwarf forms, requiring the same treatment as the Teas. Commonly known as the *Fairy Rose*.

Garden-group 15. *Pernetiana*. Crosses of Hybrid Teas and "Austrian" brier. Habit generally like Hybrid Teas but more vigorous, with stout spines and coarse



3463. Paul Neyron rose. A good rose-colored variety of the Hybrid Perpetual type. ($\times \frac{1}{2}$)

shiny foliage. The chief distinction, however, is in the remarkable coloring of the flowers, which is indescribable, but often spoken of as "shrimp," with blendings and shadings of burnished copper. Tendency to shed foliage unless grown on almost pure clay. Some forms, as *Juliet*, show affinity to Austrian in resisting pruning, but later kinds are closer to Tea. Type *Madame Edouard Herriot*.

Garden-group 16. *The Musk*. Very fragrant: rather tender: derived from *Rosa moschata*: flowers of pale color. This group has been much hybridized with others, and its identity is lost as a garden plant in that of its derivatives, especially the *Noisette*. The flower-buds are elongated and the flowers produced in clusters.

Noisette (Fig. 3466). Larger flowered than the true Musk roses, flowering very late: free growth: more hardy. The group bears a certain superficial resemblance to the Teas and requires moderate pruning; will grow in any soil. The subgroup has been largely blended with the Teas and with a loss of hardness. In consequence it has fallen into disuse.

Garden-group 17. *Ayrshire*. Perpetual forms of the *Ayrshire*. For characters, see Summer Roses.

Garden-group 18. *Perpetual-flowering varieties of the Multiflora group*. The term in gardens is taken to include a large number of small cluster-flowered, climbing roses, and is particularly important in American rose-culture, as the basis of a new section of hybrids with the Teas and (erroneously) including hybrids of *Wichuraiana* and Teas. M. H. Walsh in Mas-

sachusetts, M. Horvath in Ohio, and Jackson Dawson in Massachusetts have accomplished important work in this field. Some of Walsh's recent introductions, as Debutante and Sweetheart, not as yet fairly tried, and the Dawson rose, may be classed here. They are valuable as trellis and pillar roses for garden decoration.



3464. *La France*, a famous Hybrid Tea rose. ($\times \frac{1}{2}$.)
This picture was made from the White *La France*. The original *La France* is pink.

Garden-group 19. *Perpetual Briers*. Of this group there are about five important types.

Rugosa or Japan rose, a low-growing bush: hardy: useful as a hedge plant, and specially adapted for exposed situations near the seashore (Figs. 3446-3448). Hybrids have been made with other Perpetual groups, especially Teas and H. P.'s. Mme. Georges Bruant is a type. The *Rugosa* blood is strongly seen in all cases.

Microphylla has minute leaflets; now called *Rosa Rozburghii*.

Berberidifolia has leaves somewhat resembling barberry; now known as *Rosa persica*.

Perpetual Scotch, a perpetual-flowering form of *Rosa spinosissima*, probably a hybrid from the Damask.

Garden-group 20. *Evergreen*. Two types, as follows:

Macartney, slender: sweetly scented and very floriferous throughout the season. Is derived from *R. bracteata*.

Wichuraiana. The Wichuraiana hybrids already referred to under Group 7 may dubiously be included here. They have not yet been sufficiently tested. The perpetual-flowering Ramblers have foliage partaking of Wichuraiana and Tea characteristics.

LEONARD BARRON.

Propagation of roses.

The rose is propagated by seeds, cuttings, grafting or budding, by layers and by divisions. The genus is so large and diversified and the requirements are so

many that the whole art of the propagator is needed to satisfy the claims of the Queen of Flowers.

Seeds.—Roses are grown from seeds not only to obtain new varieties but also because many true species are economically procured in this way, e. g., *R. canina*, *R. multiflora*, *R. ferruginea*, *R. rugosa*, *R. rubiginosa*, and the like. The seeds should be gathered in autumn and at once stratified with moist sand or allowed to ferment in tubs with a little water, and kept in a fairly warm place. When well rotted they can be easily rubbed and washed clean and should be planted at once, either in carefully prepared and well-manured beds out-of-doors or in pans or flats in a cool greenhouse. It is sometimes advised that the hips should first be dried and then rubbed clean, but this method often causes delay in germination, a matter sufficiently troublesome without additional complications; they should always be kept moist. Whether they are planted under glass or in the garden it is difficult to forecast their coming up. It may be within a few weeks, e. g., *R. multiflora* under glass; or at the beginning of the second growing season after planting, e. g., Sweetbrier seed planted out-of-doors in November, 1914, may be expected to germinate in the spring of 1916, while *R. rugosa* sown at the same time may come up the following spring, i. e., in 1915, or, a season intervening, it will appear with the Sweetbrier in 1916. Stratifying or fermenting the seeds tends to secure uniform germination within a reasonable time. It has also been suggested, and many things confirm the idea, that early gathering helps to hasten germination; in other words, do not wait for excessive ripeness, but pick the hips as soon as the seeds harden, some time before the fruit is deep red. Until these matters are better understood, all rose seed sown out-of-doors, either in autumn or spring, should be mulched 2 to 3 inches deep with pine needles or other litter. Frequent examinations should be made in spring and the covering at once removed when the seedlings appear; if they do not appear, let the mulch remain to keep down weeds and retain moisture in the seed-bed. Pans or flats in which seed has been planted should be kept at least eighteen months before discarding, with the soil always moist. Notwithstanding the difficulties of germination, the young seedlings make most satisfactory growth and may generally be transplanted into nursery rows when



3465. Yellow Tea rose, *Madame Honore Defresne*, useful in the South. ($\times \frac{1}{3}$)

one year old. When two years old they are fit for permanent planting. A winter protection of pine boughs is helpful to the young plants. Some seedling roses are extremely precocious, blooming before they are one year old, e. g., some Hybrid Perpetuals and so-called Polyantha roses. The first flowers of seedling roses do not always indicate their real character: in hybridizing it is well to wait for the second or third season before discarding.

Cuttings.—A common means of propagation, under glass and out-of-doors, is by cuttings.

Under glass short cuttings 2 to 3 inches long can be made in November and December from wood of the current year's growth. They should be firmly planted in sand, in flats or pans (Fig. 3467) and kept in a cool greenhouse. They root in February or March, and can either be potted in thumb-pots or kept on in flats until May or June, when they should be planted out in rich beds; salable plants are obtained in October. This is a good way to strike *R. setigera* and its varieties, Crimson Rambler and its allies, *R. multiflora*, and their various offspring, *R. Wichuraiana* and its hybrids, Madame Plantier and doubtless many others. *Rosa indica*, in all its forms, all tender species, and many Hybrid Perpetual roses, are propagated by cuttings of hardened wood grown under glass. Peter Henderson says the wood is in the best condition when the bud is "just open enough to show color." Blind eyes can also be used, and the smaller wood is better than the strong rampant growth. Plant in sand and in a warm house; bottom heat and a close frame are often used but are not necessary. The cuttings are from 1½ to 2 inches long; single eyes strike readily.—In the open air, cuttings of ripened wood may be planted in spring in V-shaped trenches in carefully prepared and well-manured ground. They make strong plants in autumn. Wood of the season's growth is gathered before severe frost, cut into 6-inch lengths, tied in bundles, and stored through the winter by burying in sand. When planted, one eye only should show above ground. This method is recommended for the hardy varieties named above for propagating from short cuttings under glass, but will not give such a large percentage of rooted plants. It is highly probable that some Moss roses, *R. virginiana*, *R. palustris*, *R. spinosissima*, and the like, roses which sucker, can be propagated by cuttings of root or rootstock, but no systematic attempt has been made in this direction.

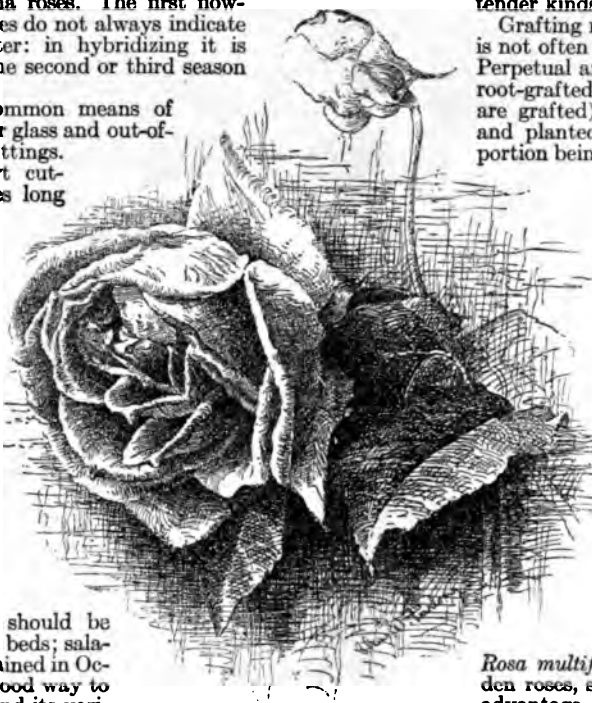
Budding and grafting.—These are old and well-established methods of propagation. Budding in foreign nurseries is practised in the open air, in June and July, with us in July or August. A dormant shield-bud is employed. The stock is *R. Manetti*, *R. canina*, or any good briar, or *R. multiflora*; in Holland *R. palustris* is esteemed. In European nurseries, *R. canina* is used

for standard, *R. Manetti* for dwarf stocks. Under glass roses are budded also, with a shield-bud, at any season when the bark slips, using for stock a vigorous variety. About Boston the yellow and white Banksian roses once had high local repute for stock for Tea and other tender kinds.

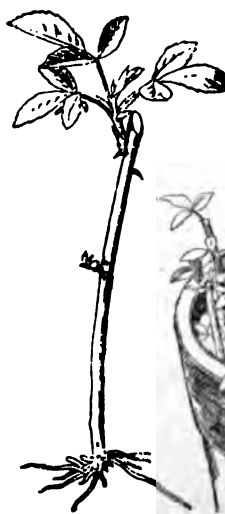
Grafting roses in the open air in this country is not often employed, but in the South, Hybrid Perpetual and other hardy roses are said to be root-grafted in winter (very much as apple stocks are grafted), tied in bundles, stored in sand, and planted out in early spring, the worked portion being set well below the surface. Root-grafting is an easy and convenient method of propagation under glass. Jackson Dawson's practice is to use the whip- or splice-graft, but the veneer-graft is also employed, with bits of *R. multiflora* root 2 to 3 inches long for the stock, the cion being somewhat longer but of equal diameter. They are firmly tied with raffia and waxed; made into bunches, they are covered with moist moss in an open frame in a coolhouse and left until united. They are then potted off and grown on until they can be hardened off and planted out in May or June, the point of union being well below the surface. A specimen of Dawson's work is shown in Fig. 3468, the stock being a bit of *R. multiflora* root; its age is about three months.

Rosa multiflora is an excellent stock for garden roses, since it does not sucker; this great advantage, is also obtained by using the root-graft as above described. (See article on roses in *Country Life in America*, March, 1916, by Geo. C. Thomas, Jr.) The commercial florists use Manetti stock planted in thumb-pots.

Cut back to the crown, this is splice-grafted and kept in a warm close frame until united; plants are afterward grown on in pots until large enough to put out in the beds, in which they will flower the following winter. There is some difference of opinion among gardeners as to the respective merits of own-root and grafted plants: just now many of the foremost growers prefer the latter for forcing. It is a perplexing question and could be settled by only a series of exact experiments costing much time and



3466. Marechal Niel rose. One of the most popular of the Noisettes. Color yellow. (X½)



3467. Short hardwood cuttings of *Rosa setigera*. A single cutting is shown at the left.

money. It is also quite possible that matters of temperature, soil, moisture, and food are equally important factors.

Layering.—This method is employed only when few plants are required; it is cumbersome and wasteful. Layer in early spring, using wood of the last year's growth when possible; the bark of the buried portion should be abraded.

Division is an easy means of increasing *Rosa virginiana*, *R. nitida*, *R. palustris*, *R. spinosissima*, Crimson Moss and many other varieties which sucker. Plant thickly in good soil, allow them to grow from three to four years, then lift and tear apart. It will be found that the increase is large and that plants so obtained are salable after one year's growth in the nursery. The year in the nursery may be omitted with the quicker-growing kinds which are to form new plantations on the same estate.

B. M. WATSON

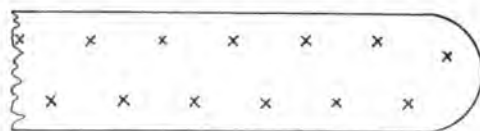
Roses for the amateur.

Roses may be successfully grown in any soil that will produce fair crops of grain, vegetables, or grass. Certainly the best results will be secured in the more favorable soils and situations, but everyone who loves a rose and possesses a few feet of ground with plenty of sunshine can have his own rose-garden and find pleasure and health in cultivating the plants.

The soil and the beds.

The ideal soil is a rich deep loam, but a good rose-bed can be made in clay, sand, or gravel at little expense and labor. Even the city resident whose house has been erected on the site of an exhausted brick-yard, at a small expense can secure sufficient good soil from the outskirts and manure from the adjacent stables to make a rose-garden that will grow as good plants and flowers as those of his more favored friends who have acres at their disposal, provided always that the sunlight can reach the beds for at least half the day.

The preparation of the ground is the first step of importance. Roses are injured by wet feet, and if the soil is wet it must be thoroughly drained. This can be accomplished by digging out the bed to a depth of 3 feet and filling in 1 foot with broken stone, bricks,



3469. A good rose bed.

cinders, or anything that will allow a free passage of the water through the soil. If this is not sufficient and the water is not carried away, provision must be made for tile-draining; but, except in very extreme cases, the drainage before mentioned will be found amply sufficient. The composition of the soil should depend on the class of roses to be grown, for the Hybrid Remontants do best in a heavy soil containing clay, while those having Tea blood prefer a lighter, warmer ground.

The beds may be made of any desired shape, but a width of 4 feet will usually be the most satisfactory, as a double row can be planted at intervals of 2½ feet, which will be all that is necessary for the strongest-growing varieties, and the blooms can be gathered from each side without the necessity of trampling on the soil. Space may be economized by planting as in the diagram, Fig. 3469.

The plants will then be 1 foot from the edge and 30 inches apart, and each plant will be fully exposed to light and air and will not interfere with its neighbors.

In preparing a bed on a lawn, the sod and earth should first be entirely removed and placed apart; then the best of the subsoil may be taken out and placed on

the other side of the trench, and, lastly, the portion to be discarded is removed, making in all a depth of at least 2 feet. The bottom or floor is then loosened to the full depth of a pick-head, the good subsoil replaced and mixed with a generous dressing of well-decomposed stable manure; lastly, the surface soil and sod are well broken up and also thoroughly enriched with manure, and the bed is filled to the level of the adjoining surface with enough good soil added to replace the discarded earth. When the bed has settled, the surface should be at least 1 inch below that of the

3468. Grafting of Crimson Rambler on *Rosa multiflora*, showing plant three months old. At the right is shown the detail of the splice-graft.

adjoining sod, in order that all the rainfall may be retained. It is a mistake to make any flower-bed higher than the adjacent surface, as in hot weather the soil dries out and the plants suffer.

If the bed is intended for the hardy Hybrid Perpetual or Remontant class, it should contain a fair proportion of clay well mixed with the soil. A sufficient amount is always present in what is known as a heavy loam. If the soil does not contain this naturally, the material should be added and thoroughly incorporated with the other ingredients. If the bed is intended for Hybrid Teas, Teas, Bourbons, or Noisettes, the soil should be lighter, and, if naturally heavy, should have added to it a proper quantity of sand or leaf-mold, and be thoroughly mixed as before. Roses are rank feeders; therefore be liberal with manure for every class.

The plants and planting.

Garden roses may be secured from the dealers grown in two ways: on their own roots, and budded on the Manetti or similar stock. There is much difference of opinion among growers as to the relative value of the two methods of propagation, and it must be admitted that some of the stronger varieties will do equally well either way; but the opinion of the writer, based upon the experience of more than a quarter of a century, is that all of the less vigorous varieties are far better budded

than on their own roots, and some are utterly worthless unless budded, notably, *Reine Marie Henriette* and *Viscountess Folkestone*, both charming roses when well grown. The budded plants are mostly grown in Europe, taken up as soon as the wood is ripened in the autumn, and shipped to us in the dormant state in time for planting in the latitude of Philadelphia before the ground is frozen. They are usually received in such excellent condition that rarely one in a hundred of the hardy sorts



3470. Flower of the *Manetti* rose, used as a stock.

fails to make a good growth, and a fair bloom the following season.

With the tender sorts, dormant planting out-of-doors in late autumn is attended with much risk, because of the inability of these plants to endure the rigors of our winters before becoming established. Consequently they need much more protection than the hardy varieties. It is really much better to defer the planting until the early spring, if the

plants can be safely housed through the winter. After they have become successfully established their safety is assured, and they will repay in vigor and excellence the extra work expended on them. Few amateurs, however, have the conveniences for caring for a number of plants under cover in the winter. Therefore they must take the risk of planting in the autumn or cultivate plants grown on their own roots. (For further discussions of budded and grafted roses, see page 3005.)

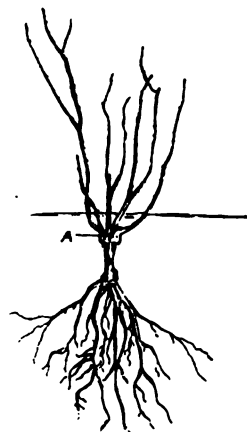
For budded roses, holes at least 1 foot deep and 15 inches wide should be made for each plant, the collar or point where the bud was inserted and from which the new growth starts placed 2 inches beneath the surface of the soil, the roots spread out and downward (care being taken that no roots cross each other), and all roots covered with fine soil free from lumps of manure. (Fig. 3471.) Manure should never be placed in actual contact with the roots, but near at hand, where the new feeding roots can easily reach when growth begins. The remaining soil should then be packed in firmly, the surface leveled and covered with about 3 inches of coarse litter and manure, and the long wood cut back to about 18 inches to prevent the plant being whipped and loosened by high winds. This extra wood is left to encourage root-action in the spring and should be cut back to three or four eyes as soon as they can be detected when pushing out. Always cut above and close to a strong outside bud, without injuring it, to develop an open and free head, this admitting light and air. If the uppermost bud is on the inside surface of the shoot, the new growth will be directed inward, dwarfing and hampering the plant and preventing proper development. The deep planting above described is necessary to prevent suckers from being thrown out by the roots, as these will speedily choke and kill the less vigorous wood which we are endeavoring to develop. From the writer's experience, the only objection to budded plants is this danger of suckering from the roots; therefore no one should attempt to cultivate budded roses who cannot distinguish the brier should it appear, or who is too careless to dig down at once and cut the wild shoot clean off at the root, rubbing it smooth to prevent its starting again. A very little experience will enable anyone to distinguish the brier. The canes are covered with minute thorns and bear seven leaflets, instead of the usual five. Should any doubt remain, follow the shoot down through the ground and if it starts below the collar, it is a brier; remove it. These wild shoots

usually appear a few inches outside of the regular growth, rarely inside; consequently there is little difficulty in detecting and removing them.

Roses from pots should be planted as soon as the spring weather has fairly settled and all danger of frost is over, that the plants may be firmly established before the heat of summer. Roses planted late in the season never do well. The holes need be made only a little larger than the pot in which the plant is growing. Choose a cloudy day, or the time just before a rain, or late in the afternoon, and, after making the hole, knock the pot off by inverting the plant and striking the edge sharply on a firm object (the handle of a spade which has been firmly placed in the ground in an upright position will answer well). Press the ball of earth firmly between the hands to loosen the earth without injuring the roots, fill the hole with water, insert the plant a very little deeper than it stood in the pot, fill in with soil and pack the earth around it firmly. Pot-grown plants always require staking if the varieties are of upright growth.

Tea roses make a charming effect, where the climate is too cold to winter them in the open successfully, by planting in a bed 6 feet in width, the rows 1 foot from the edge and 2 feet apart, and the bed of any desired length or any multiple of 3 feet. A sectional frame made from tongued and grooved fence-boards, 2½ feet in height at the back and 2 feet in front, facing east or southeast and fastened together with hooks and eyes or screws, the whole covered with ordinary coldframe sash (6 by 3 feet), will preserve the tender varieties through a severe winter. The sash should be freely opened when the temperature is above 30° F. and air admitted during the day when it is 10° or 15° lower. Always close before sunset and open as soon as the sun shines each morning. Opening the sash to keep the plants cool and prevent growth is just as essential as covering to protect from cold, if abundance of flowers is desired. A few days' neglect in opening the sash when the temperature is above 30° will destroy most of the buds for the coming June, as they will be forced out, and one cold night will kill them. Protect from rains or snows, and do not water. Sufficient moisture reaches the roots from the outside to keep the plants in a healthy condition. Teas may be grown successfully in such a bed for many years, and give hundreds of fine blooms from May until November and remain so vigorous that many of the new shoots will be ½ inch in diameter.

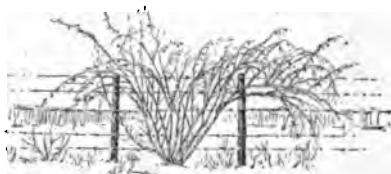
Climbing roses make a very effective background, and if trained on a high wire fence give a beautiful display. The strong-growing varieties should be planted 8 feet apart and will each easily fill a trellis 9 feet high. They also look well trained on the house porch, but are much more likely to be attacked by insect enemies than when planted in the open. Roses grown on porches are usually attacked by aphids and slugs, the leaves becoming riddled and skeletonized, which only infrequently occurs when they are planted in the open sunny garden. If roses are wanted around porches, the *Microphyllæ*, white and pink, and the *Crimson Rambler* can be safely planted, as they are not attacked by the slug; but the blooms do not compare favorably with many other roses of their habit. The other varieties



3471. A typical dormant rose as it should be planted. A, point where bud was inserted.

may also be grown around porches, provided that they can be planted where the drippings from the roof will not fall on them and they are kept free from slugs.

Climbing Teas can be grown successfully in the latitude of Philadelphia only in the case of a few varieties.



3472. *Reine Marie Henriette*, the finest climbing Tea rose for the latitude of Philadelphia. This shows the vigorous growth, the trellis being 10 feet wide and 9 feet high.

Many of the finer kinds are worthless, in spite of all the protection that can be given them, unless they are covered with glass. *Lamarque*, *Bouquet d'Or*, *Cloth of Gold*, *Triomphe de Rennes*, *Marechal Niel*, and *Reve d'Or* have, in the writer's experience, all perished in the first winter, but *Reine Marie Henriette*, *Gloire de Dijon*, *William Allen Richardson*, and *Celine Forestier* will do well and yield satisfactory results. *Reine Marie Henriette* blooms finely and makes a magnificent growth, as may be seen in Fig. 3472. The trellis is 10 feet wide and 9 feet high.

Hybrid Sweetbriars, of the *Marquis of Penzance* kind, are a valuable addition to rose collections. The foliage is abundant, healthy, vigorous, and fragrant, and the exquisite shading of each variety forms a beautiful contrast with the others. It would be difficult to choose among them, for all are worthy of a place, when there is sufficient space for them to revel. They should have a high trellis and be planted fully 8 feet apart.

Pruning roses.

Of the common garden roses, the flowers are produced on new wood of the season that arises from the canes or the crown, or else, in the case of shrubby species, from old trunks or arms. It should be the aim of the grower to secure strong clean canes for this flower-bearing, and not to have so many of them on each plant as to produce much small weak bloom.

Standard or "tree" roses are sometimes grown, but they require so much care in keeping down suckers and in staking and tying, that they are little known in this country. They are grown abroad when a few excellent blooms are desired or where space is limited. These tree roses are top-budded, on strong stocks, to the desired variety. Sometimes an effect approaching the true tree rose is produced by tying up a few very strong canes to a stake, as shown in Fig. 3474. The usual type of rose-bush in America, however, of the *Hybrid Perpetual* class, is shown in Fig. 3475.

Pruning the dwarf-growing *Hybrid Perpetuals* may be begun late in March and regulated by the quantity or quality of the blooms desired. If the effect of large masses be wanted, four or five canes may be left 3 feet in height and all very old or weak growth entirely removed. This will give a large number of flowers, effective in the mass but small and with short weak stalks scarcely able to support the weight of the heads and not effective as cut-flowers, as this sort of pruning is entirely for outside show. After the bloom is entirely past, the long shoots should be shortened back, that the plant

may make good and vigorous wood for the next season of bloom. But if quality be desired, all weak growth should be removed, every remaining healthy cane retained and cut back to 6 or 8 inches. Always cut just above an outside bud, to make an open head that will admit light and air freely. After the first season's growth, there may be about three canes to be retained, but with good care and cultivation the number will increase yearly, until after fifteen or twenty years there will be at least as many canes to be utilized as the plants are years old. The writer had a bed over twenty years from planting, in which each plant, after close pruning, measured 15 to 18 inches in diameter, each cane throwing up four to six shoots 1 to 2 feet in length and sufficiently vigorous in most varieties to hold up the largest flowers and to give magnificent specimen flowers for cutting. Roses grown in this way do not need stakes. They are sufficiently strong and vigorous to hold erect any weight they may be called upon to bear; but late in the autumn, before the high gales of November arrive, they should be cut back to about 2 feet to prevent their being

whipped by the winds, for this would loosen the plant and break the newly formed feeding-roots. The plant should not be cut back to the point suggested for spring pruning, as in the hot Indian summer the upper eyes will surely be forced out and the promised blooms for the ensuing season destroyed; so in pruning for protection from November blasts, enough wood should be left to avoid all danger of the lower buds being forced out. The upper buds always develop earliest. Some varieties will not produce large flower-stalks under any method of treatment, notably *Prince Camille de Rohan*, *La Rosarie*, and *Rosieriste Jacobs*; but almost all the other kinds do better under this method than any other, if quality is desired.

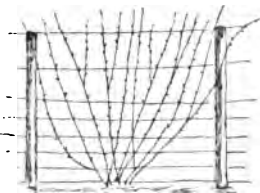
Pruning dwarf-growing Tea roses is conditioned on the fact that they will not endure such vigorous cutting back as the *Hybrid Perpetuals*. All good strong shoots should be retained unless they form a very close head, when it is better to remove a few from the center. The canes should be shortened about one-third of their length, the branches cut back to one or two eyes, and after each period of bloom the longest shoots should be trimmed back sparingly.

Bourbons need even less trimming. *Souvenir de Malmaison*, *Mrs. Paul*, and others of this class should have only the weak ends of each shoot removed, and no more wood cut away than is necessary to remove weak and unhealthy parts.

Climbing roses should be pruned sparingly by simply shortening-in the too vigorous shoots and cutting the laterals back to two eyes. Tie all to the trellis in a fan shape, dividing the space as evenly as possible. Fig. 3473 shows the same *Reine Marie Henriette* pruned and trained on trellis. These continue in flower until November, the early bloom in June being the finest.



3474. Rose trained to a few shoots.



3473. Illustrating the pruning of the rose shown in Fig. 3472.

Hybrid Teas should be pruned for quality, and the proper time is when the buds are swelling. The amount of wood to leave on the plant varies with the variety. Shortening the shoots to 4 to 8 inches gives fair results. Cut back the weak growers more severely than the vigorous kinds. To provide for good blooms later, leave three good buds in the axils of the leaves at the base of the shoot when removing flowers or withered blossoms (Beal).

Hybrid Sweetbriers require only such pruning as to shorten back the over-vigorous growth and occasionally to remove some of the oldest shoots to prevent crowding.

Tillage.

Just before growth begins in spring, the surplus rough manure should be removed from the beds and all the remaining fine particles forked in. Deep cultivation is not desirable, as the roots are likely to be injured or broken. Three inches in depth is quite sufficient for a bed that has not been trampled on, and this should be performed with a four-tined digging-fork, which is less likely to cause injury to roots than a spade. The beds should then be neatly edged and the surface raked off smooth and even. Frequent stirring of the surface with a sharp rake is all that is necessary afterward, until the buds begin to develop. Then half a gallon of weak liquid manure applied around the roots of each plant just before a shower will be beneficial. The manure-water should be prepared beforehand, and as soon as a good promise of rain appears, all hands should be called into service and every plant given a full ration. One person should dig a shallow trench with a garden trowel around each plant, the next follow and fill with the liquid manure, being careful to avoid besmirching the leaves; afterward the bed may be raked over level and the rain will wash the food to the roots. This feeding may be repeated with benefit every week until the season of bloom is over, after which stimulation should cease and the plants be permitted to perfect the new wood for the next season's growth. Little pruning is necessary with "cut-backs." So much wood has been removed in gathering the blooms that but little more is left than needed to keep the plants vigorous and healthy. There is another advantage from the system of close pruning: all growths are so strong and vigorous that they are better able to resist insects or disease.

The notion that roses exhaust the soil in a few years and require to be changed into new ground is generally accepted, and is true in most cases; but when beds are formed as previously described and budded roses planted, the vigorous feeding roots find sufficient nutriment in their far-reaching growth to support a healthy development of wood and flowers for many years, especially if a generous top-dressing of manure be applied each autumn and liquid manure supplied liberally during the development of the buds. A top-dressing of wood-ashes after the first spring tillage will materially increase the vigor of the wood and flowers.

Varieties.

The following roses are sufficiently hardy for planting, with more or less protection, even in central New York, where all have been tested (Beal):



3475. A well-grown rose-bush.

Hybrid Perpetual.—Alfred Colomb, A. K. Williams, Anna de Diebach, Baron de Bonstetten, Baroness Rothschild, Captain Christy, Captain Hayward, Clio, Dr. O'Donel Browne, Duke of Edinburgh, Duke of Teck, Frau Karl Druschki, General Jacqueminot, George Arends, Gloire de Chedane Guinoisseau, Gloire Lyonnaise, Hugh Dickson, J. B. Clark, John Hopper, Lady Helen Stewart, Madame Gabriel Luizet, Magna Charta, Margaret Dickson, Marshall P. Wilder, Mrs. John Laing, Mrs. R. G. Sharman-Crawford, Oscar Cordel, Paul Neyron, Prince Camille de Rohan, Ulrich Brunner.

Hybrid Tea.—Antoine Rivoire, Augustine Guinoisseau, British Queen, Caroline Testout, Chateau de Clos Vougeot, Chrissie Mackellar, Dean Hole, Dorothy Page Roberts, Duchess of Sutherland, Duchess of Westminster, Earl of Warwick, Edith Part, Etoile de France, Francis Scott Key, Frau Lilla Rautenstrauch, Geoffrey Henslow, George Dickson, Grace Molyneux, Gruss an Teplitz, Gustav Grunerwald, Hector MacKenzie, Irish Brightness, Jonkheer J. L. Mock, Kaiserin Augusta Victoria, Killarney, Killarney Queen, Königin Carola, Lady Alice Stanley, Lady Ash-ton, La France, Laurent Carle, Lieutenant Chaire, Madame Jules Grolez, Madame Hector Leuillot, Madame Second Weber, Marquise de Sinety, Mevrouw Dora Van Tets, Monsieur Joseph Hill, Mrs. A. R. Waddell, Mrs. Wakefield Christie-Miller, Old-Gold, Prince de Bulgarie, Queen Mary, Simplicity, Souvenir du President Carnot, Souvenir de Gustav Prat, Sunburst, Viscountess Folkestone, Wellesley, White Killarney, Willowmere.

Perpetua.—Arthur R. Goodwin, Louise Catherine Breslau, Lyon, Madame Ruau, Rayon d'Or, Soleil d'Or.

Polyantha or Baby Rambler.—Bordure, Catherine Zeimet, Cecile Brunner, Clothilde Soupert, Ellen Poulsen, George Elger, Gruss an Aachen, Leonie Lamsch, Louise Walter, Madame Jules Gouchault, Maman Turbat, Marie Brissonet, Marie Pavie, Mignonette, Mosella, Mrs. W. H. Cutbush, Schneekopf, Triomphe Orleansais.

Moss roses.—Blanche Moreau, Comtesse de Murinais, Crested Moss, Crimson Globe, Princess Adelaide.

Hybrid Sweetbriers.—Amy Robart, Anne of Geierstein, Brenda, Catherine Seyton, Edith Bellenden, Flora McIvor, Green Mantle, Jeannie Deans, Julie Mannering, Lady Pensance, Lord Pensance, Lucy Ashton, Lucy Bertram, Meg Merrilies, Minna, Rose Bradwardine.

Hardy Yellow roses.—Austrian Copper, Harison's Yellow, Persian Yellow.

Bourbon and Noisette.—Beauty of Rosemawr, Burbank, Caroline Marniesse, Champion of the World, Hermosa, Mrs. Paul, Souvenir de la Malmaison.

Hybrid China and Gallica roses.—Madame Plantier, Rosa Mundi, York and Lancaster.

Rugosa hybrids.—Agnes Emily Carman, Conard Ferdinand Meyer, Madame Georges Bruant, Madame Lucien Villemot, Nova Zembla, Perfection l'Hay, Blanc Double de Coubert.

Climbing roses, large-flowered types.—Baltimore Belle, Christine Wright, Climbing American Beauty, Countess M. H. Chotek, Dr. W. Van Fleet, May Queen, Prairie Queen, Ruby Queen, Tausendschön, W. C. Egan.

Climbing roses, many-flowered types.—Count Zeppelin, Crimson Rambler, Dawson, Dorothy Perkins, Excelsa, Gardenia, Goldfinch, Lady Gay, Lady Godiva, Minnehaha, Mrs. F. W. Flight, Mrs. M. H. Walsh, Rene Andre, Rubin, Source d'Or, Thalia, Trier, Wartburg, White Dorothy.

Climbing roses, single-flowered types.—American Pillar, Bonnie Belle, Delight, Eisenach, Evangeline, Jersey Beauty, Hiawatha, Leuchstern, Paradise, Pink Roamer, Silver Moon.

Tea-scented roses.—Duchesse de Brabant, Harry Kirk, Helen Gould, Isabella Sprunt, Madame Lambert, Madame Joseph Schwartz, Maman Cochet, Marie Lambert, Mrs. Herbert Hawksworth, Papa Gontier, Princess de Sagan, Souvenir de Catherine Guillot, William R. Smith, White Maman Cochet.

Climbing Tea and other tender roses.—Birdie Blye, Climbing Testout, Madame Alfred Carriere, Madame Driout, Mrs. Robert Peary, Reine Marie Henriette.

Bengal roses.—Archduke Charles, Douglas, Lucullus, Madame Eugene Marlitt, Maddalena Scalarandis, Queen's Scarlet, and Viridiflora.

Single Hybrid Tea roses.—Iona, Irish Beauty, Irish Brightness, Irish Elegance, Irish Harmony, Irish Modesty, and Simplicity.

10	17	15	13	11	9	7	5	3	1
20	18	16	14	12	10	8	6	4	2

3476. Suggestions for a variety record in the notebook. 1 to 6, Her Majesty; 7 to 12, Margaret Dickson; 8 to 15, Gloire Lyonnaise; 16 to 20, White Baroness.

Much of the charm of growing roses is derived from the accurate knowledge of each variety by name. Yet few amateurs ever accomplish this, chiefly because the labels have been lost or misplaced, and not infrequently a plant becomes known to the cultivator by a name belonging to a neighboring specimen whose label has been placed on the wrong plant. To obviate this, a record should be made in a book kept for the purpose,

with a chart for each bed. Fig. 3476. This should be made at once after the plants are set out and before the labels have become detached.

ROBERT HUEY.
A. C. BEAL.†

Outdoor roses for the mid-continental region.

An intercontinental region, of which central Missouri may be considered a typical representative, often presents gardening problems which markedly differ from those in territory adjacent to large bodies of water. The longer season of intense heat combined with extreme low humidity, together with the frequently sudden and extreme fluctuations in temperature, both during winter and summer, so influence vegetation that if the same degree of perfection is to be attained, and competition successfully met, horticultural operations must be strictly orthodox, and confined to fewer varieties than may be grown elsewhere. This appears to be preëminently true in outdoor rose-growing. This crop can be as successfully produced under the varying conditions to which the region is subject, providing well-established rules, practised by expert rose-growers everywhere in planting and cultivation, are strictly followed, and if the right varieties are chosen. The most hopeless situation is the congested city conditions with air contaminated with poisonous gases. Energy and enthusiasm in gardening in such a place are better spent with other plants.

In planning a location and the arrangement for roses, the purposes for which they are to be grown must be considered. A rose-garden separated from other features of the ground is becoming more and more an important part of parks and private estates. Into this area are grouped a general collection, or specimens of all kinds. It should have a sunny position, though the ground-surface may gradually slope in any direction. Other conditions being identical, a gentle northerly slope is preferred. The kinds may be grouped by types, color, and habit of plant, with all specimens of one kind together rather than the different varieties mixed, —the rugosa, briars, and wild roses bunched in masses, and the climbing sorts on a pergola or trellis. The general dwarf kinds are arranged in irregular or geometrical beds, which, for the sake of convenience, should not be more than from 4 to 6 feet in the greatest width, but of any desired length. Rose-beds may also be located on other parts of the grounds. Low, swampy or poorly drained soil should be avoided, and the beds well separated from trees or large masses of other shrubs. Tea and Perpetual roses should not



3477. *Rosa rugosa*. ($\times \frac{1}{2}$)

be grown as single specimens, but always in groups or beds.

Suitable hedges may be made from many varieties of roses: notably rugosa and its hybrids for a broad or thick hedge, Orleans for a dwarf, and Gruss an Teplitz for medium to tall. Hybrid Perpetual sorts may also be used. With the exception of rugosa, it is better to



3478. Russian form of *Rosa rugosa*. ($\times \frac{1}{2}$)

plant in double rows, about 9 inches apart, the plants 18 inches to 2 feet apart, alternating in each row.

Shrubby masses containing roses only or with an admixture of other shrubs may be made by using wild species, sweetbrier, and rugosa. Climbers and trailers are well and largely used on porches, trellises, tree stumps, and to trail on banks, mounds, and the like.

Types and varieties.

While the Tea roses are the most tender of the groups, many of its varieties can be made to succeed by selecting a location most sheltered from extreme cold, and by providing a thorough winter mulch. Without the latter provision it is useless to attempt any varieties of this type. The following are among the best for this region: Etoile de Lyon, yellow; Maman Cochet, silvery rose; Maman Cochet White; Perle des Jardins, yellow; Mme. Francisca Kruger, coppery yellow; William R. Smith, creamy white; Duchesse de Brabant, pink.

As a type, the varieties of the Hybrid Tea group are more hardy and bloom as freely and continuously as the Teas. There are exceptions with some of the varieties. There is considerable variation in the different sorts, the character of some partaking strikingly of the delicate Teas, while others resemble the more vigorous Hybrid Perpetuals. Many kinds display the best qualities of both types, having their long flowering period and beautiful blooms of good substance, preëminent among which are: Gruss an Teplitz, scarlet; Jonkheer J. L. Mock, pink; General MacArthur, scarlet; LaFrance, pink; Kaiserin Augusta Victoria, white; Antoine Rivoire, pale yellow; Mrs. Aaron Ward, yellow; Lady Ashtown, soft rose; My Maryland, salmon-pink; William H. Taft, pink; Helen Gould, carmine-red; William Shean, pink.

The Hybrid Perpetual is a still hardier type in which are to be found varieties producing blossoms that command the highest prices because of their large size, good substance, and long stems. The most noted representative is American Beauty, still largely grown under glass and in many localities out-of-doors, but for the latter purpose not now generally counted on for the degree of success usually attained by other kinds in

this region. The limited season of flower-production, and the unattractive plant-display the remainder of the year, places this group second to the Hybrid Teas in usefulness for outdoor culture, even though little or no winter covering is required with the one, while it is important that some protection be provided for the other in the more northerly section of this region: General Jacqueminot, brilliant scarlet-crimson; Coquette des Alpes, white; Ulrich Brunner, cherry-red; Frau Karl Druschki, snow-white; Victor Verdier, crimson; Paul Neyron, dark rose; Madame Charles Wood, scarlet; Magna Charta, bright pink; Mrs. John Laing, soft pink.

Roses of the dwarf rambler class are as hardy as Hybrid Perpetuals and as continuous as Hybrid Teas. The dwarf compact habit, together with the clustered masses of bloom, gives it a distinction all its own. The class is very showy in the garden, but with rather short stems, and therefore less valuable for cut-flowers. Occasionally the blossoms bleach a little in conditions following alternate rain and warm sunshine, but this fault is more than outdone by the wealth of color produced over most of the period from beginning of blooming to frost: Clothilde Soupert, rosy white; Baby Rambler, crimson; Baby Rambler, pink; Orleans, red; Katherine Zeimet, white.

The varieties and hybrids of *Rosa rugosa* are useful, especially in landscape masses and usually make excellent hedge-rows. (Figs. 3477-3480.) The single-flowered forms produce bright red hips or seed-vessels that remain on the bushes late in the winter. The bright green leaves give these and similar varieties an interesting and pleasing appearance a large part of the season. Good varieties are: *R. rugosa alba*, white; *R. rugosa rosea*, pink; *R. rugosa rubra*, red; Madame Georges Bruant, double white; and others.

Hybrids of the Sweetbrier type are most charming when in bloom, though the flowers are only medium to small in size, and endure for less than a fortnight. It produces conspicuous fruits and fragrant foliage. The plants are a little slow in making their growth, but meet all weather conditions without injury and live to a great age. The plants form a good shrubby mass or border group. Three good varieties are: Lord Penzance, Lady Penzance, Brenda.

Many of the native species of roses are well used for mass planting, similar to the Sweetbriers. There are several American species known to thrive and bear abundant bloom at St. Louis: *R. palustris*, *R. virginiana*, *R. setigera*.

The most valuable climbing roses for this region fall under two types, *R. multiflora* and *R. Wichuraiana*. Isolated examples have been reported of other forms doing equally well, but the above are by far the most common, and the varieties give so wide a range of color as practically to make other forms unnecessary. They grow rapidly in good soil, and when trained to tree-stumps, trellises, walls or the sides of buildings, quickly make a thorough covering. For covering solid walls and sides of buildings it is better to provide lattice-work a few inches from the building to give opportunity for free circulation of air between the wall and the vines. The *Wichuraianas* are especially adapted for trailing over banks, mounds, and the like. Good varieties are: Crimson Rambler, crimson; Dorothy Perkins, both pink and white.

After several years' experience with Moss roses, the writer has never seen a plantation that was as satisfactory as other types. At St. Louis they were no more hardy than Hybrid Teas and appear to be more subject to mildew than any other roses. The blooms were not superior to other roses and are rarely grown except by persons maintaining collections of old-fashioned flowers, from whom some good reports have been made. They are more valuable here for their associations than for real horticultural merit.

Soils.

Roses take most kindly to a heavy clay loam enriched with well-rotted cow-manure. Such a soil is characteristically abundant in this region. Sand and ground limestone are added to the average clay loam unless it is known that the soil already contains enough of one or more of these ingredients. Except for Tea



3479. *Rosa rugosa* var. Kaiserin. ($\times \frac{1}{2}$)

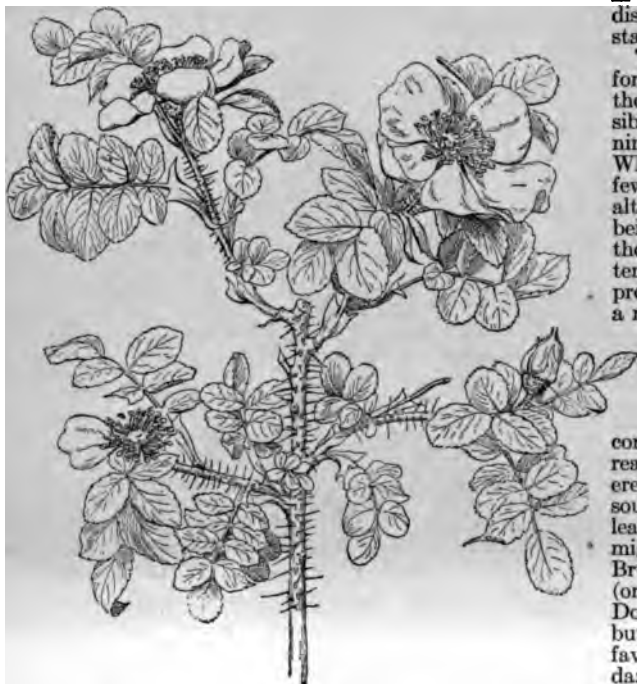
roses, lighter soils are avoided as much as possible, and even the Teas do better in ground moderately compact.

Great care must be exercised in the preparation of the soil and providing perfect drainage. Ground for a rose-bed should be excavated 2 to 2½ feet deep and the lower 6 inches filled with pieces of rock or broken brick. The bottom should be connected with a drain-tile to carry the surplus water quickly to a lower level. About a foot of cow-manure, preferably rotted, should be spread over the broken rock and brick, and the excavation filled with heavy clay loam of sufficient depth to keep the surface when settled slightly lower than the surrounding level. To most soils in this region some form of lime should be added to neutralize any acidity that may occur. If there is a greater proportion of clay than loam in the soil a little pulverized sheep-manure, dried blood, or other quick-acting chemical fertilizer will provide available plant-food immediately and give the plants a better start.

Planting.

In starting a rose-plantation, the stock may be dormant wood or growing plants in 3- or 4-inch pots. The plants may have been grown from cuttings on their own roots or budded or grafted on other stock. Plants on their own roots are equally good, cheaper to buy, and there is no danger of the stock plants making growth from the roots in place of the desired kind. Most roses in this region are grown on their own roots. Dormant roses may be set out either in fall or spring, using preferably one- or two-year-old plants. Spring is the most common season, but autumn-planting is practised by some and considered equally good, or even better by many successful growers. The plants are set in the ground 2 or 3 inches deeper than they originally grew, and if planted in autumn, earth is drawn up around the stem and the ground mulched with the most convenient material suitable for the pur-

pose,—rotted manure, leaves, straw, pine needles, and the like. All broken roots are removed and the top cut back to three or four buds. Potted plants are started from cuttings taken in August, September, or October, rooted under glass and grown on during fall and winter to a 3- or 4-inch pot, hardened off in a coldframe, and set out when the ground is warm. For Teas and Perpetuals, the potted plants usually give more bloom the first season and are equally good the following years. There is less labor in planting and the potted stock is no more expensive than dormant material. In setting, the plants are removed from the pots with the soil intact, placed a little deeper than the ground-level, and watered. A frequent and serious error is made in setting



3480. A *Rugosa* hybrid.—Harrison's Yellow \times *R. rugosa*. ($\times \frac{1}{4}$)

the plants too close. They must have plenty of room for light and air. The Baby Ramblers should have about 18 inches apart; other dwarf roses about 2 feet; climbers 4 feet. The surface is cultivated a few times, and at the beginning of hot summer weather the ground is given a thorough mulch, preferably of rotted manure. This feature is probably the most important operation in making a success of monthly roses in this region. Cultivation and mulching should be continued each year, and about every fifth season Tea and Perpetual roses should be lifted and reset after the ground has been thoroughly shaped.

Pruning.

Roses are pruned in the dormant season, mainly in the early spring, and the method varies somewhat with the different types, as well as individual plants within the types. The severity of the preceding winter often governs the amount of pruning, especially with Teas. Plants are sometimes frozen to the ground unless winter protection is given, when it is necessary to remove practically all of the top. All dead wood should be removed. As a general rule, uninjured plants of Teas should be pruned more severely than others. The stronger the growth the smaller the proportion of wood to be removed. Climbers, rugosa, sweetbrier, and wild roses need only enough to keep the plants in shape and

to the desired size. In pruning rose-hedges, a special effort should be made to keep the base as full of new growth as possible.

H. C. IRISH.

Roses in California. (Fig. 3481.)

In many localities in California the rose attains a striking and perhaps unique perfection. That this perfection is not general throughout the state is partially owing to adverse conditions, such as great range of temperature during each twenty-four hours, heavy fogs at critical periods, and the like, but as a rule, failure in whole or in part is due to the lack of intelligent treatment. In the present article, the conditions in southern California are specially in mind, but the discussion will apply, in the main, to other parts of the state.

The chief obstacle to successful rose-culture in California is the attempt to produce blooms every day of the year. Although this practice is quite an impossibility with any rose, the evil is still persisted in by ninety-nine in every hundred possessors of a garden. While roses are grown in great profusion in Los Angeles, few, if any, do as well here as in Pasadena, which, although only 9 miles distant, has the advantage of being several hundred feet higher than Los Angeles, and therefore less subject to fog or great range in daily temperature. In some places a certain few roses will produce an astonishingly fine crop of bloom, when but a mile or two distant, with no change of soil and very slight difference in altitude, they will be utterly worthless; while a like number of other varieties will give as good returns as those first mentioned.

Many roses do fairly well everywhere, and among these Duchesse de Brabant more nearly produces a continuous crop of blossoms than any other. For this reason it stands in a class by itself and is not considered in the appended list of the best dozen roses for southern California, though every one should grow at least one bush of this variety. Along with the Duchesse might well be placed the Polyantha, Mademoiselle Cecil Brunner, and the climbers Cherokee, Banksia, Ophir, (or Gold of Ophir), Beauty of Glazenwood or Fortune's Double Yellow. All these produce most wonderful crops, but none more so than the last mentioned, which in favored regions produces a wealth of flowers simply dazzling to behold. Many well-known Californian writers assert that Gold of Ophir and Beauty of Glazenwood are one and the same rose, but this is not the case. Gold of Ophir was here for many years before the other made its appearance, and some of the original plants are still growing on many of the homesteads of Los Angeles and vicinity.

All the roses named thus far are worthy of a place in any garden. One of the chief causes of failure by the average amateur is the lack of an intelligent knowledge of the plant's first requirement—recurring periods of absolute rest. These necessary resting-periods are best secured by the withholding of the water-supply. Most amateurs, and a larger part of self-styled "gardeners," persist, against all rules of common sense, in planting roses either in the lawn or in mixed borders with other plants. In either case, all but the roses require a constant watering. Having planted in this fashion, the grower has cast away all chances of first-class results. Rose-beds should never be made a feature in landscape gardening, as the plants when dormant and judiciously pruned are unsightly objects at best. The most obscure spot obtainable with the proper exposure is the place to grow flowers. To obtain the best results the rose requires the same amount of rest here that it secures where the winter season leaves the grower no alternative. But the same amount of rest may here be given semi-annually, with equally good and perhaps better results than is possible with one long annual period of inactivity.

Climate is the all-important feature of rose-culture in California, and if that is satisfactory the character of the soil makes little difference. The dry summer air is a serious drawback to the growth of many roses, there being few places where Moss roses thrive, and these must be grown in whole or partial shade. Niphetos and Marechal Niel are good examples of roses requiring partial shade if good results are desired. Many localities cannot grow the two last mentioned, or such as Perle des Jardins, Meteor, Catherine Mermet, Madame Francisca Kruger, Reine Marie Henriette, and many others, on account of mildew. Even among varieties whose buds are immune, it is often impossible to get foliage unaffected. Injudicious watering is more largely to blame for these unfavorable conditions than any other agency. Laurette is a rose which often produces the only perfect flowers to be found among a hundred varieties, and this is particularly the case in places visited by heavy frosts, Laurette remaining unscathed while all others are more or less blasted. The great rose of the eastern United States, American Beauty, is almost a complete failure here and is not worth growing except in a very few well-favored gardens, and even then it is far from being perfect.

Persons in the southern end of the state and inland sections have yet to learn that fine roses may be grown in summer either in light or heavy shade.

Many roses, also, are of little value in California unless budded or grafted. Of this class Marechal Niel is the most striking example. Examples may be found where this rose has thrived unusually on its own roots, but such cases are marked exceptions. Some persons maintain that all roses are best on their own roots, but such opinions are easily refuted by consulting any of our veteran rosarians. The best roses are root-grafted, but of course this procedure is too expensive for the general nurseryman, and the bulk of the local stock is budded on Manetti or Maiden's Blush, though the Dog rose (*Rosa canina*) and even the Banksia are often used. Those roses grown on their own roots are usually propagated from hardwood cuttings, grown out-of-doors, and December is usually the best month, although they have been successfully rooted from October to March, according to the variety.

Rust bothers but little; likewise scale, although in many neglected gardens the bush and climbers alike may be found covered with both the rose-scale and the red scale of the orange. Fuller's rose-beetle is a nuisance only in small areas, but green-aphis is a pest in winter and spring. La France for many years was the leading rose in California and grew well, budded or on its own roots, in almost any locality, but is now rapidly becoming a thing of the past, though it can never be wholly discarded, for it is still, in a few gardens, the queen of the family; its involuntary retirement from our rose-gardens is due entirely to a "die back" (anthracnose), which affects many other plants than the rose, but seems to have a special liking for La France. Thus far no cure has been found.

(1) A list of the best dozen bush roses and the best half-dozen climbing sorts, as agreed upon by many experts within a range of 20 miles of Los Angeles, is as follows:

Bush roses.—Frau Karl Druschki, Kaiserin Augusta Victoria, Madame Abel Chatenay, Heinrich Munch (Pink Druschki), The Lyon, William Shean, Magna Charta, Ulrich Brunner, Edward Mawley, General MacArthur, Lady Hillingdon, Duchess of Wellington.

Climbing sorts.—Climbing Kaiserin Augusta Victoria, Lamarque, Climbing Souv. of Wootton, Francois Crousse, Duchesse de Auerstadt, Reve d'Or. Outside this list are members of widely divergent classes which should find a place in every large garden, such as the Banksias, the three Cherokees, and both the bush and the climbing Cecile Brunner.

(2) Following are lists of a dozen varieties each of the

different recognized standards of color of roses which have proved best adapted to southern California conditions:

White: White La France, Frau Karl Druschki, Ivory, Kaiserin Augusta Victoria, Mabel Morrison, Molly Sharman-Crawford, Niphetos, Perle von Godesburg, The Bride, The Queen, White Killarney, Maman Cochet. *Pink:* Belle Siebrecht, Betty, Clara Watson, Killarney, Madame Abel Chatenay, Madame Leon Pain, Mlle. Cecile Brunner, Paul Neyron, Maman Cochet, Souv. du President Carnot, The Lyon, William Shean. *Red:* Agrippina, American Beauty, Edward Mawley, General Jacqueminot, General MacArthur, Hugh Dickson, J. B. Clark, Jonkheer J. L. Mock,



3481. California rose-bush.

Lady Battersea, Magna Charta, Papa Gontier, Ulrich Brunner. *Yellow:* Duchess of Wellington, Franz Deegen, George C. Waud, Harry Kirk, Lady Hillingdon, Marie Van Houtte, Mrs. Aaron Ward, Mrs. A. R. Waddell, Perle des Jardins, Rayon d'Or, Soleil d'Or, Sunburst.

Climbing roses.—*White:* Devoniensis, Kaiserin Augusta Victoria, White Maman Cochet, Madame Alfred Carriere, White Banksia, White Cherokee. *Pink:* Belle Siebrecht, Cecile Brunner, Caroline Testout, Dorothy Perkins, Gainsborough, Pink Cherokee, Tausendschön. *Red:* Papa Gontier, Souvenir of Wootton, Crimson Rambler, Francois Crousse, Red Cherokee (Ramona), Reine Marie Henriette, Reine Olga de Wurtemberg. *Yellow:* Beauty of Glazenwood, Celine Forestier, Duchesse de Auerstadt, Marechal Niel, Reve d'Or, William Allen Richardson, Yellow Banksia. *Sunset and Copper:* Mrs. A. R. Waddell, Lady Hillingdon, Duchess of Wellington, Juliet, Sunburst, Mrs. Edouard Herriot, Los Angeles.

(3) Following are roses suitable to California as a whole (John Gill): General MacArthur, Madame Caroline Testout, Lady Hillingdon, Juliet, George Dickson, Mrs. Aaron Ward, Radiance, Mad. Abel Chatenay, Miss Kate Moulton, Ulrich Brunner, Ophelia, Mlle. Cecil Brunner, Frau Karl Druschki,

Laurent Carle, Irish Elegance, Lady Perrie, Miss Cynthia Forde, Sunburst, Betty, My Maryland, White Maman Cochet, Rayon d'Or, George Arends, Mad. E. Harriot.

Climbers.—Climbing Testout, Climbing Belle Siebrecht, Climbing Cecile Brunner, Francois Crousse, Gainsborough, Reve d'Or, Climbing Papa Gontier, Climbing White Cochet, Caroline Goodrich, Climbing Sunburst, Madame Alfred Carriere, Duchesse de Auerstadt.

ERNEST BRAUNTON

The cultivation of roses under glass.

The growing of roses for cut-flowers is the largest item in the greenhouse industry of America at the present time, and the total sales amount to many millions of dollars annually. The rose industry is the backbone of the florist business. With the introduction of varieties that are prolific bloomers, roses have reached a selling value which puts them in reach of the purse of the masses of the people, and the demand is unlimited. Exhibitions have been a factor in educating the public to know roses and in bringing about their present popularity.

The industry is widespread and embraces every section of the country. Southern California grows good roses for the markets in the open field and better quality under glass. In the dry central portion of the West where roses were once considered an impossibility, they are now grown with good success. The climate of the eastern part of the United States seems particularly well adapted to roses, and this section has been considered the home of the greenhouse rose industry. However, careful knowledge of climatic conditions and proper treatment will produce good roses in almost any locality which is favored with weather cool enough to allow proper time for maturity of the flowering stems which, if forced into flower by excessive heat, do not, in warm climates, produce the quality of bloom that is obtainable where more time can be given their development by lower temperatures.

Types of rose-houses (Figs. 3482, 3483).

There are two distinct types of greenhouse construction used by the large commercial rose-growers. The single house has the approval of many, while the connected houses, or ridge-and-furrow sections, are favored by others, because of the smaller expense of construction, the lower cost of heating owing to the absence of outside walls, and the ease of superintend-

ence. Advantages of the single house are its better control, more light, and less trouble with snow and ice, the latter being a serious consideration in the maintenance of the connected houses.

The single house is constructed with iron frame and concrete sides and built even span or two-thirds span to the south. Houses strong and permanent, with good ample ventilation and ample light seem to be the essentials of construction. With connected houses, the essential factor in addition to these is to have the gutter at least 12 feet from the ground, which almost entirely overcomes the effect of shade which the gutter casts by diffusing this over a larger area. A heating-pipe beneath the iron gutter to assist in melting snow and ice is a necessity.

The size of houses to be preferred is largely a question of opinion, but there are certain factors which must not be overlooked. The wide house must necessarily be high, and a house that is high is likely to be lacking in humidity, and the plants consequently will suffer. This seems to be the only objection of consequence to the wide single house. From 40 to 60 feet is the normal width and should be satisfactory, and the length is controlled by the capital of the owner or the natural lay of the land. Houses are workable with economy up to 1,000 feet provided, naturally, with crosswalks at least every 300 feet to save steps for employees. The width of connecting houses should be from 36 to 44 feet, and the length as given also applies to these connecting houses.

Beds and benches.

There is but small connection between the bed or bench and the house containing them, except that in planning new construction the approved plan is to have a walk next to the outside walls and, if the proper width house is selected, this can be accomplished without varying the width of walks and beds or benches. As the modern house is relatively high at the plate or eave, either bed or bench may be used at the discretion of the builder. The construction of the bench is simple, the essential point being durability; this is secured by using cypress lumber and double cross-pieces, which enables the builder to put nails back a short distance into the bottom board and prevents the breaking of the bench at the joint, as the bottoms usually decay first at the ends of the boards. Benches not over 24 inches to the bottom from the ground surface are to be preferred, being easier to work, as the larger part of the actual labor is on the plant itself, at least 12 inches above the bench surface and, if the bench is higher, the labor is correspondingly harder. Ample drainage must be provided by leaving cracks between bottom boards from $\frac{1}{4}$ to $\frac{1}{2}$ inch and using 6-inch width boards. The concrete bench for rose-growing is in the experimental stage and has not as yet shown superiority.

The solid bed, so called, is not in reality solid, except as to side walls. Ample drainage of the ground itself is needed, if solid beds are to be built. If the soil is naturally gravelly, the making of solid beds is simple. If the soil is of heavy clay texture, the building of the solid bed necessitates not only under-draining the surface, but the supplying of coarse gravel or ashes through which the water from the soil may escape to the permanent drain-tiles. These drain-tiles should be laid crossways of the house every 100 feet, and the smaller tile running lengthwise under each bed should empty into these larger cross-tiles. Sides of solid beds are best built with concrete which can be made as thin as $2\frac{1}{2}$ inches



3482. Commercial rose-house showing method of staking, wood-bench construction, and connecting houses.

at the top, and the outsides can be made perpendicular. The inside should be on an angle, and a base width of 6 inches with the flare on the inside will give the wall a purchase on the soil under the bed and hold it in place. Solid beds are cheaper of construction, provided the land is naturally well-drained. They are more expensive when much ashes or gravel must be used. There is another type of solid bed made by using plank nailed to posts for siding which is just as good, but not durable. The bed built by laying broken stone, to serve as drainage, and which elevates the bed to a better working level, is a permanent and satisfactory one, but natural conditions as to stone make this impracticable under usual conditions. Results as to roses grown on raised tables or benches and on solid beds vary very little. The raised bench having the heating-pipe beneath it seems to produce better in the winter months. The solid bed having a cooler soil and a greater rooting depth will give a better quality in the summer months. On the yearly average there is small difference in quantity and quality of product, and the question of bed or bench must be settled by the opinion of the owner and the questions of cost and permanence.

Heating.

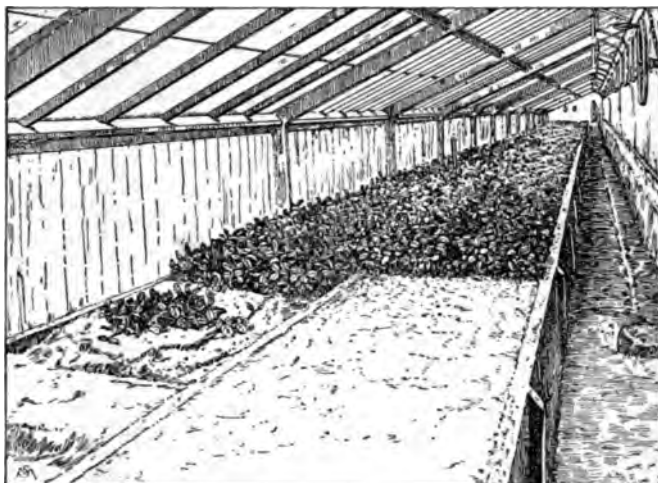
In close connection with houses and beds is the question of heating. It is a universally recognized fact that steam heat is essential to the growing of good roses. No attempt will be made to explain boilers and the piping of the houses, except to say that sufficient steam-pipes must be supplied to carry normal temperature in the coldest possible weather, that such pipes should be evenly distributed over the area inclosed, and that the heat should not be overhead, but on the level with or below the level at which the plants are set. The use of steam is due to the fact that quick heat in rose-houses is necessary. The change that comes with the dropping of the sun in the fall and winter must be counteracted by a quick steam-service to prevent a chilling of the plants. A pipe or two in all big houses in summer nights prevents the condensation of moisture on the plants and means the difference between success and failure. Hot-water heat is more uniform than steam, but loses because steam can be obtained on much shorter notice. The use of a hot-water system in conjunction with steam is admirable, and in large establishments is to be recommended. The gentle warmth radiating from the hot-water pipes during the day is not detrimental and enables the grower to use more ventilation, which is a distinct benefit.

Soils for roses.

Soils for rose-culture should be of clay body, but have enough of more friable ingredients to pulverize readily. The grower usually chooses land for the building of commercial rose-houses which has on it the character of soil required. Good heavy clay turf is the material from which to form the compost for rose soil. The fiber of the turf as it decays gives the humus required and leaves the soil open, porous, and in good condition for root-action. Winter-preparation is to be preferred, and the freshly prepared compost which is not over six months old is in ideal condition. Piling alternate layers of soil and cow-manure, using two parts of good heavy clay turf to one part of cow-manure, makes an ideal rose soil. Horse-manure may be used with good results, or a mixture of the two, but cow-manure has the preference.

Lowland soil usually has the body and fiber that is needed, and soil which is part of the year under water has been found to be free from eel-worm or nematode,

which attacks the rose roots; this troublesome pest often infests the soil of the uplands. The meadow soil should be plowed into ridges in the fall and hauled on frozen ground to the place where it is to be composted. The thorough freezing of the soil is considered beneficial as it tends to make it more friable. The compost should be worked over when the frost has gotten out, and after settling will be ready to use when needed. A point should be made to lay the soil-compost near the sec-



3483. Rose propagating-house.

tion where needed in order to save labor in handling when filling the houses.

Greenhouse propagation of roses.

Roses are propagated in two ways for greenhouse growing. These two methods will be discussed separately, considering roses on their own roots before taking up grafted roses.

The usual type of wood selected for own-root cuttings is the strong non-flowering growths. These are commonly known as blind-wood cuttings, but experiment has shown that these growths, if stopped or pinched, as the process is called, can be made to flower, which refutes the statement that such growths are blind, and from these growths flowering plants are produced, which shows clearly that the flowering ability is present. Whether varieties run out by constant use of this type of cutting is an open question which only long-continued experiment can answer, but observation has shown that certain varieties, if propagated from this surplus, or so-called blind growths, will tend to reproduce more of that growth in proportion and to lessen the production of strong flowering wood. The problem seems to be to get into the cutting a sufficient number of dormant eyes to provide good strong flowering growth, and the cutting of this type taken to the heel or union of the shoot with the flowering stem will have such dormant eyes and make a stronger, more vigorous, better producing plant than the cutting which consists of the top few eyes from a growth of this character.

The cutting of flowering stems is usually heavier than the blind-wood cutting, and the wood should be hard or mature enough to allow clean cuts to be made without injury to bark or pith. When the bud shows color is the proper stage of development for the propagation of flowering wood. Two or three eyes should be used, making a clean cut just below the eye and removing the lower leaf; trim back the top leaves at least one-half, and the cutting is ready for the propagating-bed. Cuttings should not be stood in water, but kept sprinkled to prevent wilting.

The propagating-bed should have ample drainage, which can be secured by using coarse ashes for the bottom half of the bed. Five-inch side boards with ashes for drainage and above it 2½ inches of good clean sand constitute a workable propagating medium. Rose-cuttings can be rooted with good success in screened soft coal-ashes, if sand is not available, but extra care must be taken to prevent breaking off the roots in taking the cutting from the ashes, when ready for potting. Distance in the propagating-bed depends on the variety. The leaves should not be allowed to overlap and thus invite fungus. With the heating-pipes beneath the bench, and a uniform temperature of 58° to 60° in the sand and 54° to 60° overhead, the cuttings should be rooted and ready to pot in about four weeks. Do not allow the cutting to begin growth in sand, which it will if not potted when the roots have started. Be sure that clean pots are provided, and the 2½-inch size is ample for the newly rooted cuttings. Pot carefully so that the tender roots are not broken or

bruised and be sure that some soil is between the cutting and the pot. Water carefully and provide shade for the first few days until the cutting has recovered from the check of moving. Make sure that all the soil is thoroughly moistened, but do not over-water it. Light sprinklings are all that will be required until the roots show activity, which can be ascertained by knocking the plant and ball of soil carefully from the pot, taking care not to break the ball of soil. As the plant begins to grow, remove all shade and keep the plant growing. It will require more water with the increase in foliage.



3484. Grafted rose, seven weeks from the graft.

When the plant fills the pot nicely with roots, repot into a larger pot,—the 3-inch size will be ample for its requirements for the next six weeks. Keep the young plants clean and growing, using the same treatment as for plants on the bench for the various insects and fungi. Shift into larger pots, if necessary, but keep them growing.

Grafted roses are very distinct in handling from the own-root plants. It is best to start with strong-rooted Manetti stock, which rose species has been chosen for its strength of growth and the freedom with which the cions unite with it. Manetti is grown from hardwood cuttings taken during the winter months, and which are planted in early spring in the open field. These are kept growing rapidly throughout the summer, are dug in the fall and are ready when potted for grafting. Manetti should be disbudded or suckered, which means the removal, so far as is possible, of all eyes which are below the point at which the graft is to be made. In growing Manetti, deep planting is advisable as the stem which has been under ground all summer, cuts better and makes a better union than the harder stem which has been exposed. Manetti varies very little with the section, but varies with the method of growing and grading. The deep-planted, well-graded Manetti, whether English-, French-, Dutch- or American-grown, is equally valuable and serviceable, but the great variation in the growing and handling has caused the erroneous

opinion that Manetti from certain sections is superior. Labor values alone prevent the American grower from producing his own Manetti, but irrigation is necessary in our climate. Having pencil-size Manetti,—being for the best work about the thickness of a lead-pencil,—the process of grafting is simple. A cut is made as close to the pot-level as possible diagonally across the Manetti. The cion is cut on the same slant and is tied to the stock with raffia fiber (Fig. 3484). Raffia is used because it decays and does not need to be cut away as will be necessary with string, and it covers the union more completely. The union of the cambium layer is the essential point, and if the cion is not equal in size to the stock, one should be sure of a perfect union on one side. The rapid flow of sap which occurs when the new grafted plant is put into the case covers the union and growth begins. In a temperature from 76° to 78° the first week and from 70° to 72° the two succeeding weeks, with careful ventilation and shade from hot sun, the union should be perfect and the young plant ready to be taken into the air and light when hardened sufficiently by increasing these gradually. The grafting-case is usually constructed by having sufficient steam-pipes beneath it to maintain the temperature—a miniature greenhouse.

The advantages of grafted roses over those grown on their own roots are: a stronger root-action, a more rapid-growing plant, and a root-system that will be immune to eel-worm or nematode. Experiments conducted by the Illinois Experiment Station have proved that the production from grafted roses is sufficiently larger to warrant the use of grafted plants. There may be a connection between the use of flowering wood for grafting and increased production, as all cions for grafting purposes should be from selected flowering wood. There is also a difference in varieties and a few are superior on their own roots. It has been generally stated that all yellow or yellow-tinted roses are better on their own roots, but results contradict this statement.

The after-care of the grafted plant varies little from the care of own-root plants. One should be sure to remove any Manetti suckers that appear, cutting close to the stock, and mulch once in small pots before shifting into larger, using for this mulch a compost of good rose-soil with a heavy sprinkling of bone-meal added. Repotting will furnish all the feed necessary, but the top mulch will often keep the plant growing and economize room. Grafted plants come into bud and flower early. The blooms should be kept cut off.

General cultivation, diseases and insect pests.

Having good, clean, thrifty, young plants in 3- or 4-inch pots and a compost soil in the benches or beds, one is ready for planting. The correct spacing is about 12 by 18 inches or 14 by 16 inches; there is some difference in varieties, but the average is about as stated. Planting should be deep enough to cover the union by an inch or more with grafted plants and yet away from the bottom of the bench. Plant firmly and water thoroughly. Growth will soon begin. Keep the plants clean from red-spider by thorough and consistent syringing of the under sides of the leaves with water under pressure. Red-spider is an insect which multiplies rapidly when favored by a dry warm atmosphere, and as its sustenance is the foliage of the plant, it must be eradicated.

Stakes should be set and the plants tied to the stake as soon as they have become established and growth has begun. Wires should be run above the bench, tying the stake made of heavy wire to this 3 feet from the soil-level. In tying the stake to the wire use string, and raffia for tying plants to the stake.

The general care of a rose-house consists in keeping the house properly ventilated, heated and watered, in addition to keeping the plants clean from insects and fungi, and the cutting of the flowers. Ventilation should be given more attention than any other of these problems. How properly to ventilate a rose-house is

dependent upon the condition of the plants and the weather. It is the custom to ventilate freely on bright sunny days, and to guard the plants against draughts, which invites mildew. To obtain the maximum amount of growth, it is advisable to allow the temperature to go above the normal 70° day temperature in bright weather, giving ventilation at the same time, but not sufficient materially to lower the house-temperature. Careful ventilation at night in the summer, and the keeping of a certain amount of fire-heat to dispel dampness does away with black-spot, which disease of the foliage is favored by the condensation of dew or moisture on the plants during the night. Just how to check black-spot is the hardest problem of the rose-grower. Increased temperature with some quick-acting fertilizer and allowing the house to run warm on bright days will often check the disease by inducing quick growth and rapid sap-circulation, giving the plant the new foliage to replace that lost. When the black-spot is persistent, pruning back the plant and allowing it to start again with clean foliage may be the only way of eradication. Black-spot occurs on the Hybrid Tea varieties and, as few pure Tea roses are grown, practically all greenhouse varieties are subject to this serious fungus. Spraying with copper solutions will help to a certain extent in checking it. See the special discussion of this and other diseases, page 3019. The question of temperature is dependent upon the variety grown, but the normal is 60° at night, 70° on bright days, 65° on dark days.

Mildew is a fungus which also attacks the foliage, giving it a dusty appearance and curling the leaf. It also appears on the buds, and, if not controlled, will ruin an entire house. It spreads rapidly when once established. Dusting the plants with flowers of sulfur will kill the fungus if applied on bright days, but fumes from the evaporation of the flowers of sulfur on the steam-pipes will eradicate it much more effectively. Mildew is induced by poor ventilation. Plants should be so grown that the foliage, by constant fresh air, is kept hard and mildew-resisting. A draught from a door or broken glass will bring mildew. When the first sign appears, kill the fungus and prevent it from spreading.

The rose-midge (*Neocerata rhodophaga*) is the worst pest which the rose-grower has to combat, but fortunately this insect has been known to exist only in a few localities, and, to a considerable extent, only in the rose-growing section near Chicago. It is microscopic and is recognized first by its effect. The female deposits its eggs beneath the sepals of the flower-bud or between the folded leaves of the leaf-bud. The egg period is two days, and the maggots, as soon as hatched,

begin to attack the buds. The maggots reach maturity in seven days and then drop to the ground where they pupate and the adult fly emerges six weeks later. As the damage to the plant is done by the maggot which eats the petals, the work of the midge does not affect the growth of the plant, but the buds fail to develop, usually dropping off after being attacked by the maggots. Overgrown plants that do not flower are indications of its presence. The seriousness of the pest is apparent and no precaution is too great to prevent the rose-midge from getting a foothold. Buy plants that are grown in sections not affected. Keep the houses absolutely free from rubbish, both outside and under the benches. If the work of the insect is apparent, get rid of plants and soil in the house and grow other crops

for a season, and start afresh, which is the safest and best plan. See the specialist's account by Crosby, on p. 3019.

The rose is subject to the attack of a nematode, or eel-worm, which infests the roots. The use of Manetti for grafting purposes has, to a large extent, relieved the rose-grower of this trouble, for the Manetti root does not suffer from the attack of nematodes; the use of lowland soil is also a safeguard. Sterilization by means of steam will render soil safe and its usefulness is not impaired, but this is, as a rule, unnecessary.

Rose-galls are a bacterial disease which cause growths on the plants, varying in size, and usually brown in color. These appear at the joints or where cuts have been made. Remove these at once and do not cut them open with a knife used for cutting flowers, because the infection can be carried to the other plants in this manner. Cut off the affected branch and burn it.

Thrip is an insect which attacks the leaves and petals. It is small and its work usually can be recognized by the white lines on dark-colored flowers, showing where the surface has been eaten. Green-fly is a sucking insect which attacks the new growths. Both can be readily killed by the evaporation of nicotine preparations upon the steam-pipes, this having almost entirely replaced the burning of tobacco-stems.

Feeding the plants is accomplished by top-mulching, or by liquid fertilizer, or by using both. Aside from bone-tankage, few commercial fertilizers are in use, cow-manure, well-rotted, clear or mixed with well-rotted horse-manure, being more generally used. These manures in liquid form may be used to advantage. Feed light and often is the rule when plants are well established.

Watering depends on crop-condition. Water copiously when the plants are coming into bearing. Water less when the crop is being cut, and sparingly after the crop is cut and before the new growth starts.



3485. A forcing Tea rose. ($\times \frac{1}{2}$)

The question of humidity in the house is a serious one with the wide, large houses, and where the atmosphere lacks moisture the growths will be hard-wooded and the plants will not be prolific. It is safe to say that a house with all cement walks fails to grow good roses for lack of humidity, and the gravel or ash walk will do much toward furnishing the atmosphere the needed moisture.

Varieties.

Varieties to grow depend largely on the market to which the grower caters. There are two types of greenhouse roses: those which are at their best in the warm summer months, and those which are at their best in cooler weather.

The varieties best suited for summer cutting are My Maryland and its sports, Kaiserin Augusta Victoria, Francis Scott Key, and Mrs. Aaron Ward.

For general use, the best varieties are Killarney and its sports, which are numerous, and of which Double White Killarney, Killarney Brilliant, White Killarney, and Killarney Queen are such notable examples that they must be mentioned; Ophelia, Mrs. Aaron Ward, Mrs. George Shawyer, Hoosier Beauty, Hadley, Milady, Richmond, Radiance, Lady Alice Stanley, Jonkheer J. L. Mock, Sunburst, Mrs. Charles Russell, American Beauty, and the Polyantha roses—Cecile Brunner, Perle d'Or, and George Elgar, which are widely used for corsage bouquets and decorative work. Mrs. Aaron Ward, Double White Killarney, Mrs. George Shawyer, Killarney Brilliant, and Ophelia are the best varieties for cutting continuously for the entire year. Of these varieties mentioned, American Beauty, Mrs. George Shawyer, Radiance, Lady Alice Stanley, and Sunburst are better grown upon their own roots, while the balance of the varieties are superior when grafted on manetti. Mrs. W. C. Whitney was formerly grown as a forcing rose.

Cutting the flowers.

Proper care and cutting of the flowers has as much to do with financial success in the rose industry as the proper growing of the plants. Just when flowers are mature enough to be cut is a matter of variety to a considerable extent. Those varieties which do not have many petals should be cut in the bud, while many of the very double varieties, such as Francis Scott Key and Mrs. Charles Russell, should be allowed partly to expand before being taken from the plant. How much wood to leave when cutting the flowers is also a question of variety to a certain degree, but as a rule two good eyes are sufficient. Certain varieties which naturally throw strong flowering growth from the main stems or hard wood can be cut to one eye from good-sized plants. There is a tendency of plants to increase in size and become awkward to handle if much growth is left in cutting, and production from large overgrown plants is as a rule no greater than from plants more closely headed in by carefully cutting the flowers.

It is customary with some growers to "pinch" all flowering shoots when the bud has reached the size of a pea, and this removal of the bud and first leaf causes a new flowering growth and gives a longer stem, as the flower is cut back to the proper place in the older growth. This method of pinching allows the grower to control the time of maturity of the crop very accurately, eight weeks in the early winter months and seven weeks in February and March being the necessary time for the maturity of the new flowering shoot. This varies a few days with the character of the growth when the pinching is done; those shoots nearer maturity will require less time than the softer or more immature growths. There is also a slight difference in varieties as to the time required to mature the shoot and flower. Thus pinching allows the grower to bring in a crop at the holiday season and produce flowers for exhibition use.

The stronger and more vigorous the growth pinched, the better the quality of the resultant flower and by selection of strong heavy flowering growths and by pinching and careful timing, the roses for exhibition purposes are produced.

When flowers are cut they should at once be placed in water and kept at a temperature from 38° to 42° for several hours to harden them. The stems and flowers fill with water and are then in a condition to be graded. The American Rose Society has established a grading standard to which the leading growers adhere in preparing the product for market. Length of stem is the basis, but quality and substance of bud should be in proportion to length of stem, and a poor quality flower on a large stem on the open market will by no means command the price of a good flower on a stem of the same length. In grading, keep the flowers uniform in length of stem and quality.

Marketing cut roses.

There are three methods of marketing cut roses, viz.: retailing direct to the consumer; supplying flower shops direct; and the shipment of the product to the commission stores which supply the large city florists. It is of first importance to have the product reach the consumer fresh, well hardened, and not too open, for the demand for open flowers is limited. Careful packing for the wholesale market necessitates wooden boxes with cross cleats to hold the roses from moving about in the box, which bruises the flowers. Wooden boxes allow the use of ice to keep the flowers in condition for sale. Heavy waxed paper between the layers of flowers in the boxes aids in handling them conveniently. Any precaution taken to insure the product reaching the consumer in perfect condition is a paying investment, for a good product has little value when bruised and in poor condition.

The sale of flowers direct to the consumer by the grower is becoming greater every year, many of the leading florists operating their own ranges of glass and using the product in their own store. The demand from the large cities where this is not possible to any great extent is increasing yearly. Returns from money invested is in fair proportion to the money earned by investments in any well-conducted line of production, but is dependent upon the skill of the grower and the business-like conduct of the enterprise. The risk of handling a perishable product and the property risk also is heavy, owing to wind, hail, snow, and ice. Deterioration is also heavy because of the excessive humidity necessary to good culture. Rose-growing is an industry catering to the demand for a luxury, and the path to profit is often a thorny one.

W. R. PIERSON.

Rose insects.

ROSE APHIS (*Macrosiphum rosa*).—Greenish or pinkish plant-lice about one-twelfth inch in length that cluster in great numbers on the tender tips and buds, stunting the growth and injuring the bloom; injurious both in the open and on roses grown under glass. The insect hibernates in the egg stage in the North, but in the South breeding continues throughout the winter. The eggs hatch as the buds are bursting. The aphids of the first generation are wingless as are also a large proportion of the succeeding broods, but winged forms are produced from time to time which serve to disseminate the species. The insects multiply with great rapidity, each female being capable of producing thirty to forty-five young in the course of her life. A generation is completed in less than a month.

Treatment.—Spray with nicotine sulfate (containing 40 per cent nicotine), one part in 800 parts of water—about one teaspoonful in two gallons of water. The efficiency of this solution is increased by the addition of a small amount of soap. Good results may be obtained by thorough spraying with whale-oil soap, or any good soap, one pound in eight or ten gallons of water. It is sometimes a good plan to dip the buds and tips of the branches in a dish nearly full of the solution.

SMALL GREEN ROSE APHIS (*Myzus rosarum*).—A green plant-lice much smaller than the preceding; more troublesome in greenhouses than in the open.

Treatment.—Same as for the rose aphis (above).

AMERICAN ROSE SLUG (*Endelomyia rosea*).—Greenish or yellowish larvae that skeletonize the upper surface of the leaves. The eggs



C. Rose, American Beauty.



are laid in the tissue of the leaves by a shining black four-winged fly.

BRISTLY ROSE SLUG (*Cladus pectinicornis*).—Yellowish or greenish, more or less bristly larvæ about $\frac{3}{4}$ inch in length that skeletonize the leaves when young but later eat out holes in the leaf, often leaving only the larger veins. In the North there are three generations annually, the cocoons of the summer brood being placed on the leaves or twigs, those of the winter brood on the ground. The eggs of this species are inserted in the petiole of the leaves by the parent fly which very closely resembles the preceding.

COILED ROSE SLUG (*Emphytus cinctus*).—Larvæ about $\frac{3}{4}$ inch in length that feed on the edge of the leaf with the body coiled beneath it. The larva is metallic green spotted with white above, grayish white beneath; head orange; first segment of the thorax blue and the last two gray. Pupation takes place in the pith of a dead twig.

Treatment for rose slugs.—Arsenate of lead, two pounds in fifty gallons of water or one ounce in $1\frac{1}{2}$ gallons is an effective spray, but if applied too freely may leave a whitish deposit on the foliage. Hellebore, one ounce in two or three gallons of water, or used in the dry form diluted with double its weight of powdered plaster or cheap flour, is also effective. Rose slugs may also be killed with the nicotine solution as recommended for the rose aphid.

ROSE LEAF-HOPPER (*Typhlocyba rosa*).—A small nearly white leaf-hopper, feeding on the under side of the leaves, extracting the juices and causing the leaves to turn yellowish. The insect spends the winter as eggs which are inserted in the bark.

Treatment.—This leaf-hopper may be controlled by thorough spraying of the under side of the leaves with nicotine solution as recommended for the rose aphid.

ROSE LEAF-ROLLER (*Archips rosaceana*).—Black-headed olive-green caterpillars, about $\frac{3}{4}$ inch in length when mature, that roll and web together the leaves on which they feed. They become full grown in about a month and transform to dark brown pupæ within the rolled leaves. In two or three weeks the light brownish moths emerge and deposit their eggs on the leaves. There are two broods annually on roses grown in the open.

Treatment.—Spray the plants with arsenate of lead, two pounds in fifty gallons of water and make the application early in the season. In greenhouses close watch should be kept for the first appearance of the insect and the caterpillars destroyed before they gain a foothold.

ROSE CHAFER (*Macrodactylus subspinosus*).—Long-legged unguis grayish brown beetles that swarm into the rose-garden, and devour the leaves, petals, and opening buds. The grubs from which these beetles develop feed on the roots of grasses in sandy soil only. In New York the beetles emerge from the ground about the middle of June and disappear in about a month or six weeks.

Treatment.—This is a difficult insect to control because the beetles will avoid feeding on foliage poisoned with an arsenical. They will, however, eat leaves sprayed with arsenate of lead sweetened with molasses. This method, however, cannot be relied upon to protect the plants when the beetles are numerous, for much damage will be done before the poison has had time to take effect. In the case of a few choice plants it is safer to protect them with mosquito-netting during the period when the beetles are most abundant.

ROSE MIDGE (*Neocerata rhodophaga*).—Small whitish or pinkish maggots about one-fourteenth inch in length that infest opening buds, either killing them or causing the leaves and blossoms to be more or less deformed. The maggots become full grown in five to seven days, leave the buds and complete their transformation in the ground. In the summer the total life cycle is completed in about two weeks. As a rule the maggots are most troublesome during June and July. This insect is more injurious to roses grown under glass than in the open.

Treatment.—This is a difficult pest to eradicate once it has become well established in a greenhouse. Rotation with some other crop, such as violets, may be practised to advantage. Fumigation with hydrocyanic acid gas in March, when the growth of the maggots is slow, will be found of value in killing the flies before egg-laying. Fumigation does not give so good results in the summer. It is a good plan to watch the plants carefully and to pick off and destroy all infested buds. See the florist's statement on this pest, page 3017.

ROSE SCALE (*Aulacaspis rosa*).—Snow-white nearly circular scales, about one-tenth inch in diameter, encrusting the branches. More troublesome when roses are grown in partial shade.

Treatment.—Spray with lime-sulfur solution, one gallon in eight gallons of water, while the plants are dormant. It may also be advisable to cut off the worst infested stems.

ROSE CURCULIO (*Rhynchites bicolor*).—A bright red snout-beetle, with black legs and snout, which appears on the rose-bushes early in June, eating holes into the unopened buds and puncturing the flower-stems. Some of the injured buds fail to open, while others have the petals riddled with holes. The grubs feed within the buds and young fruit and in late summer descend to the ground where they spend the winter as pupæ.

Treatment.—In the garden continued hand-picking of the beetles will be found effective. In larger plantings, arsenate of lead, two pounds in fifty gallons of water—one ounce in one and one-half gallons—will destroy many of the beetles. As the beetles breed in the fruit of the wild rose, these plants should not be permitted to grow in the vicinity of the rose-garden.

ROSE SLUG-CATERPILLAR (*Euclea indeterminata*).—Occasionally in the South roses are subject to the attack of a caterpillar of striking appearance, about $\frac{3}{4}$ inch in length, orange in color, and covered with tufts of spines.

Treatment.—In small plantings the caterpillars may be picked

off by hand. While doing this work gloves should be worn, as the spines of the caterpillar emit an irritating fluid. In larger plantings the caterpillars can be controlled by spraying with arsenate of lead as recommended for the preceding.

FULLER'S ROSE BEETLE (*Aramigus fulleri*).—Small grayish brown snout-beetles about $\frac{1}{2}$ inch in length which are often very destructive to the foliage of roses grown in the greenhouse. The white, curved grubs, about $\frac{1}{4}$ inch in length, burrow in the soil and feed upon the roots of the plant.

Treatment.—Persistent hand-picking should be practised to prevent the pest from gaining a foothold in the greenhouse.

MEALY BUGS.—These common greenhouse pests are sometimes injurious to rose plants. They may be controlled by syringing the plants with tobacco extract, or a stiff stream of water may be used to dislodge them.

THRIPS.—Minute yellowish or orange insects about one-thirtieth inch in length which often injure the opening blossom-buds of roses grown under glass. They may be controlled by spraying with tobacco extracts or by the use of a sweetened poison made according to the following formula: Water, twelve quarts; paris green, one tablespoonful; sugar, three pounds.

C. R. CROSBY and M. D. LEONARD.

Rose diseases.

POWDERY MILDEW, caused by the fungus *Sphaerotheca pannosa*, is one of the most common and injurious diseases of roses wherever they are grown. It is usually first noticed as grayish or whitish spots on the young leaves or shoots. Later, as the spots enlarge, they have a white, powdery appearance, a felt-like coating being formed, especially about the thorns. The young leaves, stems, and buds are dwarfed, curled, or variously deformed. Injured leaves soon drop, and growth and flower-production is seriously interfered with. Frequently the young buds themselves are attacked by the fungus, rendering the flowers worthless.

Treatment.—(1) Under glass. Thoroughly dusting with sulfur, or spraying with potassium sulfide, one ounce to three gallons of water, every ten days is often sufficient. Ammoniacal copper carbonate is also effective. Vaporized sulfur, produced either by boiling sulfur in a pot over an alcohol lamp, or by painting the heating-pipes with equal parts of sulfur, lime, and water, can be successfully used. No time should be lost in applying one of these treatments as soon as the mildew appears. Burned sulfur is likely to injure the plants. As one of the conditions favorable to the spread of mildew is dry, cool air, such as would come into the greenhouse from ventilation, broken glass, or open door, care should be taken to eliminate all drafts. (2) Out-of-doors. Outside, rose mildew can be controlled by dusting with finely ground sulfur. Frequent applications should be made, starting with the first appearance.

BLACK SPOT, caused by the fungus *Diplocarpon rose* (more commonly known as *Actinonema rose*), is the most common and injurious disease aside from powdery mildew. Roses grown both out-of-doors and under glass are affected. The disease is most destructive during the summer. The more or less circular spots may attain a diameter of a centimeter or more, are of a black color, and are characterized by an irregularly fringed border. The spots occur on the upper surface of the leaf, and by confluence may involve the entire surface. Frequently the leaves become yellow, both in the invaded and uninvaded tissue. Defoliation soon takes place. Bushy sorts are more susceptible than the climbing varieties.

Treatment.—The fungus lives over winter on fallen leaves. Therefore, the source of spring infection will be eliminated by gathering and burning all the leaves either late in the fall or early in the spring before the buds expand. However, this is not sufficient entirely to control the disease. It is recommended that the plants be sprayed as soon as the disease becomes manifest, several applications at intervals of a week or ten days being sometimes necessary. Bordeaux mixture is said to be effective but is objectionable in that it coats the foliage. As a spray of ammoniacal copper carbonate is just as effective and lacks this objectionable feature of bordeaux mixture, it is to be given the preference.

ROSE RWY, caused by the fungus *Phragmidium* (several species), has been reported occurring on indoor and out-of-door roses. It is abundant on wild roses. The disease manifests itself in early spring as orange powdery patches on leaves, shoots, and buds. Frequently the greater portion of the surface of the leaf may be covered. The patches on the wood are often large, and distortion or curving of the part affected may occur. Toward autumn, black pustules are to be found on the under side of the leaves and on the stems, the latter of some varieties being killed to the ground.

Treatment.—All fallen infected leaves and all diseased plants or plant parts should be collected and burned. Spraying with potassium sulfide has been recommended, but further experimentation with this fungicide is desirable.

STEM CANKER, caused by the fungus *Coniothyrium wernsdorffii* (probably the same as *C. fuckelii*). Cankers are formed on the canes and branches, being characterized by a brown center with a black border, outside of which is a reddish zone.

Treatment.—Diseased canes should be cut and burned.

CROWN-GALL, a bacterial disease caused by *Bacterium tumefaciens*. The disease occurs on plants grown in the open and under glass and is characterized by galls or tubercles being formed on the stems or roots, or both.

Treatment.—Removal or sterilization of the soil by steam, thorough disinfection of the benches, and so on, is the only remedy to be suggested. Rejection of all stock showing any indication of galls is advisable.

DOWNY MILDEW is caused by the fungus *Peronospora sparsa*. It is particularly a disease of greenhouse roses, and is of somewhat rare occurrence. The disease is characterized by wilting and rapid killing of young leaves.

Treatment.—Dusting with sulfur is held to be effective against this disease.

L. M. MASSEY.

ROSE ACACIA: *Robinia hispida*. R.—Apple: *Eugenia Jambos*. Rosebay: *Nerium*. R. Campon: *Lychnis Coronaria*. R., Christmas: *Helleborus niger*. R., Japanese: *Kerria japonica*. R. Mallow: *Hibiscus*. Rosemary: *Rosmarinus*. R. of China: *Hibiscus Rosinensis*. R. of Heaven: *Lychnis Caly-rosa*. R. of Jericho: *Anastasia*, see *Resurrection Plants*. R. of Sharon: *Hibiscus syriacus*. R., Rock: *Cistus* and *Helianthemum*. R., Sun: *Helianthemum*.

ROSELLE. An annual hibiscus (*H. Sabdariffa*, page 1485, Vol. III), cultivated in tropical and subtropical regions for the acid of the immature calices and involucrels or bracteoles; known also as red sorrel and Jamaica sorrel; it also yields a fiber.

The roselle is used in the making of an acid drink and also for jellies, jams, sauces, and marmalades, being a good substitute for cranberry and currant in regions where these fruits do not grow. It is grown somewhat in the southernmost parts of the United States. The culture is essentially that of the eggplant. Seeds are sown in a seed-bed, and the young plants transferred to rows in the field far enough apart to allow of horse-tillage, and 1½ to 2 feet apart in the row. The plant usually grows 4 to 5 feet high if not too highly fertilized, and produces a bush of many stalks. No special tillage or care is required. Before the bolls are woody or stringy, they are broken off by hand. They may be utilized fresh, or dried for future use. The common forms of roselle are rich red and make very attractive products; the yellowish forms appear not to be grown in this country. The yield of one plant may be three to sixteen pounds.

ROSMARINUS (Latin, *sea-dew*; the plant is common on the chalk hills of the south of France and near the seacoast). *Labiatae*. **ROSEMARY.** Hardy evergreen shrub; a well-known garden plant, with aromatic leaves used for seasoning.

Leaves narrow, entire, with revolute margins; fls. in short axillary racemes, few, approximate, opposite, subsessile, bluish or white; calyx ovoid-campanulate, 2-lipped, posterior lip concave, minutely 3-toothed, anterior 2-cut; corolla-tube exserted, limb 2-lipped, posterior lip erect, emarginate or shortly 2-cut, anterior spreading, 3-cut, the midlobe largest, concave, declined; perfect stamens 2; nutlets smooth, ovoid-subglobose.—One species, *Medit. region*. The genus is placed near *Salvia*, being distinguished by the calyx being only shortly 2-lipped, not hairy in the throat and the connective of the anthers continuous with the filament and indicated only by a slender reflexed tooth.

Rosmarinus officinalis has small light blue flowers, which are much sought by bees. Oil of rosemary, a volatile oil distilled from the leaves, is a common preparation in drug-stores. The leaves are also used in making Hungary water. In northern herb-gardens, it lasts for years if given well-drained soil and some winter protection. It is recommended for hedges in southern California, especially for dry and rocky places near the coast.

officinalis, Linn. **ROSEMARY.** OLD MAN. Shrub, 2–4 ft. high: lvs. numerous, linear, with revolute margins; fls. axillary, in short racemes, borne in early spring. V. 3:61. Var. *prostratus*, Hort. (*R. prostratus*, Hort.), is distinguished from the type by its prostrate habit.—A good plant for dry positions on the rockery.

F. TRACY HUBBARD.†

ROTHRÖCKIA (named for Prof. J. T. Rothrock). *Asclepiadaceae*. Perennial twining herb hardy in the southwestern United States.

Stems somewhat woody at base: lvs. opposite, cordate-acuminate, long-petioled; infl. loose axillary

cymes; fls. white; calyx 5-parted; corolla rotate, deeply 5-cleft, the lobes oblong; crown simple, inserted at the junction of the corolla and stamen-tube, 5-parted; follicles thickened, acuminate, smooth.—Three species, N. W. Mex. and Ariz.

cordifolia, Gray. Lvs. opposite, slender-petioled, cordate, acutely acuminate: fls. white or whitish, in racemes; corolla-lobes 3–4 lines long. N. W. Mex. along water-courses near the borders of Ariz. and also in Ariz.—Cult. in S. Calif. F. TRACY HUBBARD.†

ROTTBOELLIA (Christen Friis Rottboell, a Danish botanist, 1727–1797). *Gramineae*. Annual or perennial, usually robust grasses of the tribe Andropogoneae, found mostly in warmer regions of the world. The species furnish some forage but they are scarcely horticultural. Spikelets in pairs as in Andropogon, awnless, arranged in cylindrical spikes, more or less embedded in the axis, the first glume coriaceous and covering the excavation of the rachis-joint. The genus is more properly referred to *Manisuris* by recent authors, this name being taken up on technical grounds.

A. S. HITCHCOCK.

ROUPALA (probably a native name in Guiana). Also spelled *Ropala*, *Rupala*, *Rhopala*. *Proteaceae*. Trees, smooth or ferruginous-tomentose, suitable only for the warmhouse.

Leaves alternate, leathery, stiff, entire or dentate, undivided, or those of the sterile branches (and younger trees?) pinnate: fls. in axillary or terminal racemes, pedicelled in pairs, perfect; perianth cylindrical, slightly dilated at base, the limb scarcely broader, subglobose, oblong or elongated, finally laxly revolute; ovary sessile: caps. hard, oblique, 2-valved, short-stipitate.—About 40 species, Trop. Amer.

Δ. *Hairs rust-colored*.

Pöhlili, Meisn. (*R. corcovadensis*, Hort.). A tree, with branches clothed with rusty colored woolly tomentum: lvs. 1 ft. or more long, pinnate, with 5–8 pairs of lfts. which are 3–5 in. long, on stout petiolules 1 in. or less long, ovate or obliquely ovate, acuminate, acutely serrate: fls. ½ in. long, white or yellowish, in nearly sessile axillary racemes 3–5 in. long. B.M. 6095.

ΔΔ. *Hairs golden*.

aurea, Lind. According to Belg. Hort. 1866:202, this species was named for the golden hairs covering the upper parts of the st. and petioles. Brazil.—Rare and imperfectly known.

R. Jönghei, Hort., is a plant offered by Siebrecht which does not appear in botanical works.

F. W. BARCLAY.

F. TRACY HUBBARD.†

ROUPËLLIA: *Strophanthus*.

ROYAL FERN: *Osmunda regalis*. R. Palm: *Oreodoxa regia*.

ROYËNA (named for Adrian van Royen, of Leyden; died 1779). *Ebenaceae*. Evergreen trees or shrubs suitable for the warmhouse.

Leaves alternate: infl. axillary; fls. small, hermaphrodite; calyx deeply 5- (rarely 4-) lobed, often accrescent in fr., lobes more or less pubescent or silky; corolla campanulate or urceolate, 5-cleft, lobes obtuse, reflexed; stamens 10 in one rank; ovary conical, pubescent: fr. globose, ovoid or oblong, leathery, indehiscent or splitting.—About 20 species, natives of Trop. and S. Afr. The genus is distinguished from the 4 or 5 other genera of the ebony family by the fls. being hermaphrodite instead of dioecious and the stamens in a single series.

Royena lucida is one of the old-time Cape shrubs formerly cultivated under glass for ornament in England and lately offered in southern California. It has small white flowers about ½ inch across, with five more or less reflexed lobes.

lucida, Linn. Tender evergreen shrub, 4-12 ft. high, or a small tree: bark nearly smooth, dusky gray or whitish: lvs. oval or somewhat ovate, leathery, shining above, more or less hirsute beneath: fls. solitary, axillary, white or yellowish; calyx 5-toothed; corolla-tube urceolate, limb reflexed, 5-parted, puberulous; segms. rounded: fr. ovoid or subglobose, red or purple and fleshy when ripe. S. Afr. B.R. 32:40.

F. TRACY HUBBARD.

ROYSTONEA: *Oreodoxa*.

RUBBER PLANTS. Various plants furnish rubber. The best gutta-percha is said to be produced by *Isonandra Gutta* (which see), a native of India. For the rubber tree of South America, see *Hevea brasiliensis*. The rubber tree of tropical Africa is *Landolphia florida*; see B.M. 6963. The rubber plant of horticulturists is *Ficus elastica*. For an agricultural account of rubber, see "Cyclopedia of American Agriculture," Vol. II.

RUBIA (Latin, *red*; referring to the color of the dye extracted from the root). *Rubiaceae*. Mostly hardy herbs, sometimes shrubby at base, of little horticultural worth, but one, *R. tinctorum*, is of economic value.

Plants frequently rather stiff, hispid, or aculeate: lvs. in whorls of 4-8 or very rarely opposite and stipulate, sessile or petioled, lanceolate or obovate, rarely cordate: fls. small or minute, in axillary or terminal cymes, 5-merous; involucre none; calyx-tube ovoid or globose, limb lacking; corolla rotate or subcampanulate; ovary 2-celled or through abortion 1-celled: fr. didymous, fleshy, 2- rarely 1-celled.—About 40 species, Medit. region, Trop. and S. Afr., Temp. Asia, Trop. and S. Temp. Amer. *R. tinctorum* is the dye-plant called madder, the long, fleshy roots of which are ground to powder. Madder is said to furnish a good green fodder if cut the second year when in flower.

tinctorum, Linn. (*R. tinctoria*, Salisb.). **MADDER.** A scandent herbaceous perennial: lvs. 2-4 in. long, sessile or very short-petioled, mostly lanceolate, not cordate, in whorls of 4-6: cymes terminal, paniced, spreading, leafy.

F. W. BARCLAY.

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RUBUS (Latin name, ultimately connected with *ruber*, red). Including *Bossèkia*, *Rubàcer*, *Oreobàtus*, *Batidæa*, and others, but excluding *Dalibarda*. *Rosaceae*. **BRAMBLE. BLACKBERRIES, DEWBERRIES, RASPBERRIES, and THIMBLEBERRIES.** Low and diffuse mostly woody plants, usually producing canes, grown for the edible fruits, some of the species for ground-cover, and others for the more or less ornamental character of habit, foliage, and bloom.

Trailing, decumbent, ascending, or erect plants, the tips of long growths usually recurving even if otherwise erect, glabrous, hairy or variously glandular, mostly thorny or prickly: sts. usually short-lived and pithy (sometimes semi-herbaceous): lvs. simple or compound, alternate, the compounding on the pinnate order and the leaflets largely 3 (several in many of the tropical and oriental species): fls. mostly white or rose-colored, usually in corymbs or racemes but sometimes solitary; calyx 5-parted (rarely 3-5-parted), the lobes persistent; petals 5, usually obovate; stamens many, inserted on the torus-rim; pistils many (or sometimes few), closely packed on the torus, usually becoming drupelets but sometimes dry when ripe, the style nearly terminal.—A most variable and perplexing genus, containing perhaps 400 fairly well-marked species and numberless intermediate forms. More than 3,000 species-names have been applied. The genus is particularly strong in Europe, where great numbers of specific names have been made (see Weihe & Nees, *Rubi Germanici*, 1822-7; Focke, *Synopsis Ruborum Germania*, 1877; Babbington, *British Rubi*, 1869; Focke, in Ascherson & Graebner, *Synopsis der Mittel-*

europäischen Flora, 1902; Rogers, *Handbook of British Rubi*, 1900, and many other publications). Focke in 1877 described 72 species inhabiting Germany. In 1902 he admitted 87 full species to the mid-European flora. There is also a large extension of the genus in the Himalayan region, about 50 species being recognized (J. D. Hooker admits 41 species in the *Flora of British India*). The species extend eastward into China and Japan. Hemsley, in his *Flora of China*, admits 41 species. In Japan, Franchet and Savatier admit 22 species. In the North American Flora, Rydberg admits 112 species, in 1913, counting those in Mexico and southward and excluding certain species that are referred to other genera. Students of the American forms should consult the recent writings of Blanchard, Brainerd, Bicknell, and Rydberg. There is no agreement as to the number of species in N. Amer. or elsewhere, and recently other genera have been segregated. *Rubus* is widely distributed in the northern hemisphere, particularly in temperate and warm-temperate parts. Some of the species are alpine and arctic. In tropical climates the genus is relatively poorly represented. Oliver admits only 4 in the *Flora of Tropical Africa*. Only 2 species are described in Grisebach's



3486. An English raspberry-blackberry hybrid. (X $\frac{3}{4}$)

Flora of the British West Indies. Baker admits 3 species in the *Flora of Mauritius* and the *Seychelles*. Hillebrand describes 3 species in *Flora of the Hawaiian Islands*. The southern hemisphere has few species. Benthams's *Flora Australiensis* has but 5 species. Cheeseman's *Manual of the New Zealand Flora* mentions only 4 indigenous species. There are also 5 species described in Harvey and Sonder's work (*Flora Capensis*) on the flora of the Cape of Good Hope region. In his *Species Ruborum* (Bibl. Bot. parts 72 and 83. 1910-14), Focke describes 429 or more species from all around the world.

The genus *Rubus* tempts the species-maker. The lines of demarcation are obscure or indefinite, the variables are numberless, the botanical characters differ widely on old and young canes and even on spring and autumn foliage of the same cane, and the plants respond readily to conditions. There are marked shade-forms and sun-forms, moisture-forms and dry-land forms, apparently only environmental modifications of prevailing types. The tendency, therefore, on the one hand is to recognize a very few stem-types as species (Bentham reduced all the British rubi of the blackberry

type to one species, *R. fruticosus*), and on the other hand to make species of the marked departures (Rogers makes more than 100 species and many varieties of the "Rubi fruticosi" of Britain). The herbarium usually provides few checks; the student needs constantly to supplement his specimens with careful observations in the field under many varying conditions, if he is to arrive at an independent judgment on the group. We do not yet know how far the older herbarium definition corresponds with phylogenetic facts. There is indication that rubi hybridize freely, particularly in the blackberry group, and artificial hybrids are produced easily; but to assume hybridity from the herbarium specimen alone is inconclusive, particularly when we have now learned that intermediateness is not a proof of hybridity and that hybrids may even show little departure from one or the other parent. If to the variableness of plants



3487. *Rubus Chamæmorus*.—The cloudberry ($\times \frac{3}{4}$). No. 1.

in the wild is to be added the variation under cultivation, the difficulties are intensified if one endeavors to name and separate very closely; and if very many species are to be made, then it may be practically impossible to identify the horticultural forms with any of the minutely defined wild species. This difficulty is likely to be little taken into account in the usual study of wild material, and yet it is an obligation of the systematist to serve the horticulturist; it would be a pity if the feral and domesticated forms were not studied harmoniously. If one is to abandon the older practice of describing the main stem-types, then the logical procedure is to name and describe all the marked forms with a Latin name. This procedure, however, relegates the group to the knowledge of the close

specialist and confuses the subject for others. Whether in certain groups of *Rubus*, particularly in the blackberry or *Eubatus* section, we are dealing with a range of hybrids between relatively few species or whether we have a wide range of plastic material out of which marked forms and incipient species are developing by mutation or otherwise, is the question of primary importance to the systematic study of the genus. The long-established habit of species-making naturally leads to the assumption that specific types occur in all genera and that the variations are to be explained on the theory of intermediateness or aberrance; but this hypothesis is yet to be demonstrated. Of course, the difficulties in cultivated *Eubatus* are not insolvable by careful study in herbarium, garden, and field.

With these points of view before us, the reader will scarcely expect to find in this account an evaluation of all the species-names that have been given to American rubi in recent years. This task may be undertaken at another time, but it would be of little avail when considering merely the horticultural forms. In assembling the American cultivated blackberries into one group in the following account and the cultivated dewberries into another, it is not intended to pass on the merits, from the systematic point of view, of any of the

several described species; but in the present state of the case, it is impossible to refer all cultivated forms to the species-names now current, nor is it the purpose of the *Cyclopedia* to describe all wild species. There is no practicable alternative but to group the horticultural forms at least until such time as the subject is cleared up; and this is done under Nos. 60 and 61. The history of these domesticated groups affords little aid in determining botanical origins, both because the records are themselves imperfect and because the American species had not then been studied critically; the problem must therefore be worked out mostly as a current systematic study.

Rubus is closely allied to *Rosa*, from which it differs chiefly in the structure of the flower. In *Rosa*, the torus or hypanthium is hollow and contains the dry fruits or achenes. In *Rubus* the torus is convex, conical or elongated, and bears the mostly soft or pulpy fruits on its surface. Rubi are chiefly shrubs with stems (canes) that die after one or two years, but some of them have herbaceous tops. In raspberries and blackberries, the canes bear the second year and then die or become very weak. The fruit is an aggregate of carpels. The drupelets are usually more or less coherent at maturity, the collective body forming the "fruit" or "berry" of horticulturists. In the raspberries, the coherent drupelets separate from the torus at maturity, causing the berry to be hollow or concave on the under side. In the blackberries, the coherent drupelets adhere to the torus, which separates at maturity and forms the "core" of the berry. Usually the tops are not long-lived, and commercial plantations require frequent renewal.

The horticultural and controlled hybrids in *Rubus* are now many. Raspberry-blackberry crosses have been frequently effected, but they appear to have little popular interest. The illustration (Fig. 3486) shows a hybrid between Fontenay raspberry (*R. idæus*) and "the common blackberry" of England as shown by Veitch at London in 1897 (G.C. Oct. 2, 1897, from which the illustration is reduced). The fruits were described as of a purplish black color with gray bloom, produced abundantly.

Relatively few of the rubi have horticultural merit, although some of them are of great importance. As pomological subjects they are more important in North America than elsewhere. Here are grown not only raspberries, which are popular elsewhere, but also great quantities of improved blackberries, a fruit that is less known as a regular cultivated product in other countries. Although the European raspberry, *R. idæus*, is grown in North America, it is mostly unreliable, and the leading commercial sorts are produced from the native *R. occidentalis* and *R. strigosus* and from hybrids of the two. Various Japanese species also produce fruits of value, but none of them has attained much importance in North America.

Numbers of the species are useful as ornamental subjects, particularly the Rocky Mountain *R. deliciosus*, the brier rose (*R. rosæfolius* var. *coronarius*), wineberry (*R. phanicolasius*), and *R. crataegifolius*. For its graceful finely cut foliage, and sometimes for its fruit, *R. laciniatus* is frequently grown, particularly in the milder climates where it is practically an evergreen. Some of the unimproved wild species are offered by dealers in native plants as worthy subjects for free borders and rock-gardens. The beauty of most shrubby rubi depends largely on the removal of the canes after they have bloomed once. After flowering, the cane becomes weak or may die outright. It should be removed to the ground. In the meantime other canes have arisen from the root, and these will bloom the following year. That is, the stems of rubi are usually more or less perfectly biennial: the first year they make their growth in stature; the second year they throw out side branches on which the flowers are borne; after fruiting, the entire cane becomes weak or dies. Removing

these canes not only contributes to conserve the vigor of the plant, but it also adds to its appearance of tidiness. These remarks apply particularly to the cultivation of raspberries, blackberries, and dewberries. For other accounts, see *Blackberry*, *Dewberry*, *Himalaya Berry*, *Loganberry*, *Louberry*, and *Raspberry*, at their respective entries.

In recent years, many of the Chinese species of *Rubus*, mostly in the subgenera *Malachobatus* and *Ideobatus*, have been introduced to cultivation for ornament, some of them with promise of providing desirable edible fruits. Many of them make long vine-like canes and are excellent for training to posts, pillars, on pergolas and arbors. The foliage is often very ornamental and several of them have white or bluish white canes that render them useful for winter effect. Some of the species are evergreen. These oriental rubuses are known in cultivation mostly in England, but are being tested in this country, particularly at the Arnold Arboretum, Boston; at the latter place, none of the species has proved to be perfectly hardy. The following species have survived, although mostly much killed back each winter: *R. fosciculosus*, *R. Lambertianus*, *R. lasiostylus*, *R. Giraldianus*, *R. mesogæus*, *R. innominatus*, *R. adenophorus*; *R. conduplicatus* and *R. teleadapos* stood the winter of 1915-16.

The species of *Rubus* require no special place or care in cultivation except to provide in a general way the conditions as to moisture and exposure under which the plants grow in the wild. They are plants of wide adaptability. Propagation is by dividing the clumps in some cases, but better by the use of the natural stolons; or if artificial practices must be employed, root-cuttings 2 or 3 inches long may be used for many species. They are grown readily from seeds.

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A. *Species herbaceous or essentially so, small, the flowering shoots arising from the crown of the plant.*

Section I. CHAMÆMORUS. Stamens numerous: fr. juicy: fls. dioecious, borne singly on upright leafy stalks: lvs. simple, lobed. The cloudberry or bakeapple-berry of arctic or subarctic regions, and much prized for its frs., belongs here. No. 1.

Section II. CYLACTIS. Fls. perfect or polygamous, singly or several together at the ends of the shoots: lvs. ternate or pediform (5-parted), or sometimes only lobed. Nos. 2-6.

AA. *Species shrubby: flowering shoots arising from woody canes of 2 or more years' growth, the plants small or large but usually large.*

B. *Plant spineless.*

Section III. DALIBARDASTRUM. The species here described are prostrate and spineless, woody, brown-hairy: lvs. simple, evergreen, cordate: fl.-sts. erect, the fls. large and white. No. 7.

Section IV. ANOPLOBATUS (*batus* is Greek for bramble). Upright rather soft-wooded shrubs, usually with shreddy bark, large, lobed lvs., large erect fls., and broad torus. Nos. 8-11.

BB. *Plant spine-bearing (exceptions in some blackberries).*

Section V. MALACHOBATUS. Climbing or prostrate shrubs with entire or palmately lobed seldom compound lvs. and mostly not showy fls.; stipules broad, fugacious. Nos. 12-24.

Section VI. IDEOBATUS. Raspberries, with the coherent drupelets separating from the torus; upright or ascending shrubs, with simple or ternate lvs., small lfts., and drooping fls. in mostly short clusters; stipules linear to lanceolate. Nos. 25-55.

Section VII. EUBATUS. Blackberries and dewberries, with the drupelets adhering to the torus when ripe; stipules linear. Nos. 56-66.

Section I. CHAMÆMORUS.

1. *Chamæmorus*, Linn. CLOUDBERRY. BAKEAPPLE-BERRY. YELLOW BERRY. MOLKA. SALMONBERRY improperly (see No. 32). Fig. 3487. Creeping: branches herbaceous, covering the ground, pubescent or almost glabrous: lvs. round-cordate or reniform, shallowly 3-5-lobed, finely dentate: fls. large and white, in solitary terminal peduncles: fr. large, globular, red or yellowish, composed of few soft drupelets, edible. Entirely across the continent in high northern and arctic regions, and reaching as far south, in the E., as the high land of Maine and N. H. and eastern end of L. I.; also in Eu. and Asia.—The cloudberry is an inhabitant of peat-bogs and cool places. It is much prized for its fr., which is gathered from the wild in large quantities. It is sometimes planted farther south as a rock-garden plant. *R. arcticus*, Linn., a pink-fl. species with trifoliate lvs., occurs in nearly the same range, and produces small edible berries; this species belongs to Section II.

Section II. CYLACTIS.

2. *pubescens*, Raf. (*R. americanus*, Brit. *R. triflorus*, Rich.). Sts. slender and trailing, 1-2 ft. long, herbaceous, without prickles, glabrous or nearly so: lvs. thin and soft, light green, with 3 or 5 ovate or rhombic-ovate, coarsely serrate lfts.: fls. 1-3 on each peduncle, small and white, the calyx reflexed: fr. small, reddish. Cold swamps, N. J. west and north.—Offered as a rock-garden plant for moist places.

3. *pedatus*, Smith. Low creeping unarmed herbaceous coptic-like perennial, rarely cult., probably adapted to cool woods or rock-gardens: lvs. pedately 3-5-foliate, with thin obovate or rhombic-obovate irregularly cut lfts. which are glabrous or only sparsely

hairy on veins beneath: fls. solitary and terminal on short shoots, white, about 1 in. across. N. Calif. and Idaho to Alaska; reported in Japan.—By Focke referred to the subgenus *Dalibarda*; if kept in a distinct genus, the plant becomes *Dalibarda pedata*, Steph. Interesting as a rock-garden plant.

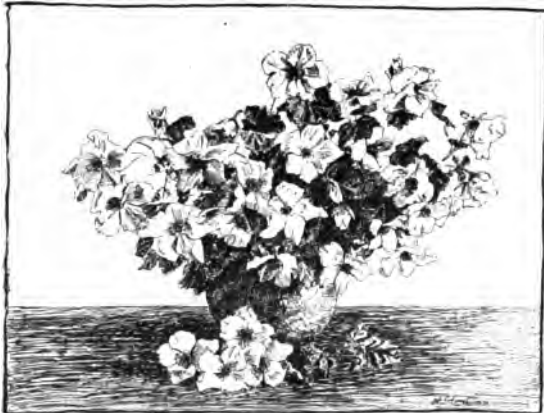
4. *stellatus*, Smith, produces an edible fr. prized in Alaska, where it is native, as well as in Yukon and Kamchatka: st. simple and herbaceous, only a few inches long, 1-fl.: lvs. cordate, 3-lobed or 3-parted, reniform in outline, pubescent on both sides or glabrate in age, simply or doubly serrate: fls. solitary and terminal, rose-colored: fr. red, globose, with 20 or more drupelets, said to be known locally as a dewberry.

5. *xanthocarpus*, Bur. & Franch. (*R. Potaninii*, Regel). Trailing, the sts. dying back every year, the sts. pilose and weak-spiny: lvs. pinnately 3-foliolate, the lfts. ovate, acute or obtuse, strongly and unequally dentate, the terminal one twice larger than the others: fls. solitary or twin in the axils of the upper lvs., the peduncle and calyx weak-prickly, the petals white: fr. large, ovate, bright yellow, fragrant, and palatable, the calyx persistent. China; discovered in 1885 in the Province of Kansu, 40° north latitude, and later found in provinces Szechuan and Yunnan.—Intro. into the U. S. in 1898 by the Dept. of Agric. through N. E. Hansen, to be tried for its edible raspberry-like fr. It is said to provide a good cover; fairly hardy in Minn; it appears not to have found favor in this country and its value is doubtful.

6. *simplex*, Focke. Small plant, 1-2 ft., making a roundish densely branched bush: sts. simple, puberulous, sparingly bristly: lfts. 3, hairy above, puberulous on the veins beneath, unequally mucronate-serrate, 2-4 in. long, the lateral ones short-stalked, the terminal on a stalk $\frac{3}{4}$ -1 in. long: fls. axillary, few, short-pedicelled, white, over $\frac{3}{4}$ in. across; petals scarcely exceeding the triangular acuminate sepals: fr. edible, orange-red. Cent. China. H.I. 20:1948.—Probably useful as a subject for rock-gardens.

Section III. DALIBARDASTRUM.

7. *tricolor*, Focke (*R. polytrichus*, Franch., not Prog.). A distinct dwarf species with prostrate spineless brown-yellowish-hairy sts., growing several feet in a season under moist shady conditions: lvs. simple, about 3 in. long, cordate, evergreen, sharply toothed, dark green above but with rows of hairs between the chief veins, white-tomentose beneath and with brown bristle-hairs on the rib and chief veins: fls. white, 1 in. across, on erect fl.-sts.: fr. rather large, bright red. W. China, up to 10,000 ft.—Probably worthy as a wild-garden and rock-garden subject.



3488. *Rubus deliciosus*, from the Rocky Mountains. (No. 9.)

Section IV. ANOPLOBATUS.

A. Lvs. mostly 7-lobed.

8. *trifidus*, Thunb. FIRE RASPBERRY. Strong-growing and erect, 7-10 ft. tall: lvs. large, palmately ribbed, 3-5- or even 7-cleft, serrate: fls. subsolitary, the peduncles villous: berry of medium size, scarlet, with pointed



3489. Clump of *Rubus odoratus* (flower $\times \frac{1}{2}$). No. 10.

drupelets. Japan.—Sparingly intro. and prized for its bright autumn foliage (whence the name "fire raspberry").

AA. Lvs. 5- or less-lobed.

B. Peduncles mostly 1-fl.

9. *deliciosus*, James (*R. Roëzii*, Regel. *Bossèkia deliciosa*, A. Nels. *Oreobatus deliciosus*, Rydb.). ROCKY MOUNTAIN FLOWERING RASPBERRY. Fig. 3488. Compact, bushy grower, reaching 5 ft.: lvs. large, orbicular or reniform, shallowly 3-5-lobed, unequally serrate, somewhat glandular: fls. borne in great profusion, pure white, 1-2 in. across, in early summer and continuing for a long season: berry hemispherical, purplish or wine-color, with larger, soft drupelets like those of a red raspberry, edible but not esteemed for eating. Cañons in the mountains of Colo., reaching 8,000 ft. elevation. B.M. 6062. G.C. II. 15:537. R.H. 1882, p. 356; 1903, p. 447. F.S. 23:2404. Gn. 18:358; 29, p. 336; 34, p. 231; 45, p. 74; 46, p. 293; 73, p. 64. Gt. 47:1451; 52, pp. 355, 356. Gng. 3:325. G.M. 41:508; 45:143. G. 2:491; 8:650; 36:411, 777.—The finest of native flowering raspberries, and deserving to be widely known. Hardy in Mass. The fls. resemble single roses.

BB. Peduncles several- to many-fl.

10. *odoratus*, Linn. (*R. grandifolius*, Salisb. *Bossèkia odorata*, Greene. *Rubacer odoratum*, Rydb.). FLOWERING RASPBERRY. MULBERRY (erroneously). Fig. 3489. Strong-growing plant, with the shreddy canes reaching 3-6 ft.: lvs. very large, pubescent beneath, 3-5-lobed, the lobes triangular-acuminate with broad triangular teeth and sharp-serrate: fls. 1-2 in. across, rose-purple, several to many in the cluster, the sepals with a long point, the peduncles and pedicels glandular-pubescent: berry flattish and broad ($\frac{3}{4}$ in. across), rather dry, light red, edible but not valued. Nova Scotia to Mich. and Ala. Gn. 34, p. 230. B.M. 323. J.H. III. 31:133. F.E. 22:557. Var. *columbianus*, Millsp. (*Rubacer columbianum*, Rydb.), native in W. Va., has lanceolate incised-dentate or doubly dentate lobes. Var. *albidus*, growing with the type, has whitish fls. and lighter-colored bark.—*R. odoratus* prefers rich shady woods and banks. It makes a bold subject in a foliage mass, and its fls. are nearly as large as many single roses, although the color is less bright. It spreads rapidly from the root and overtops weaker plants.

11. *parviflorus*, Nutt. (*R. nutkanus*, Moç. *R. lacer*, Kuntze. *Bossèkia parviflora*, Greene. *Rubacer parvi-*

florum, Rydb.). Differs from the last in having white fls. in few-fl'd. clusters and less glandular peduncles. N. Mich. to the Pacific Coast and southward in the Rockies; the western representative of *R. odoratus*. B.M. 3453. B.R. 1368. Gn. 45, p. 75; 59, p. 61; 62, p. 249; 67, p. 255.

Section V. MALACHOBATUS.

A. *Lvs. compound* (in *R. Henryi* 3-lobed *lvs. sometimes occurring*).

12. *Hénryi*, Hemsl. & Kuntze (*R. bambusdrum*, Focke). Evergreen, with trailing shoots 10–15 ft. long, with few spines and gray-tomentose when young: *lvs.* 3-lobed and of 3 lfts. often on same branch, rarely of 5, the lfts. long-lanceolate, 3 in. or more long, minutely and more or less distantly toothed, tomentose beneath: fls. small, pink, in terminal racemes 2–3 in. long: fr. $\frac{1}{2}$ in. or less diam., shining black, not unpleasant in flavor. W. China, 4,000–7,000 ft. altitude. G.C. III. 42:251; 51:148. G. 28:630.—A handsome plant for pillars and pergolas, because of its graceful growth and interesting foliage. It has been considerably advertised abroad.

13. *Playfairii*, Hemsl. (*R. Playfairianus*, Hort.). A rambling or diffuse shrub, evergreen, with thin wire-like sts. which bear small curved spines and are cobwebby when young: *lvs.* of 3–5 linear-lanceolate or lanceolate serrate lfts., the terminal one 5–7 in. long, all bright green above and gray-felty beneath, the stipules $\frac{1}{2}$ in. long and cut: fls. $\frac{1}{2}$ in. across, in irregular clusters, the petals shorter than calyx-lobes: fr. black, of fair or moderate flavor. China. G.C. III. 51:166.—Makes a handsome plant when trained up on stakes.

AA. *Lvs. not compound, although sometimes lobed*.

B. *Infl. terminal and racemose, simple; peduncles solitary*.

14. *malifolius*, Focke. Sts. prostrate or climbing, woody, with few short curved prickles: *lvs.* simple, oval or oblong-elliptic, coriaceous, 2–5 in. long, broadly but shallowly toothed: fls. 1 in. across, in short terminal racemes: fr. rather large, black, flavor unpleasant. W. and Cent. China.—Said to be an elegant species with handsome fls. Named for its apple-like *lvs.*

15. *hupehensis*, Oliver. Deciduous, with prostrate terete sts. somewhat gray-flocculent when young, with very short curved prickles: *lvs.* simple, oblong-lanceolate, about 3–4 in. long, acuminate, rounded at base, serrate, gray-tomentose beneath, short-petioled: fls. 3–7, in a terminal short raceme. Cent. and W. China. H.I. 19:1868. A related species is *R. Swinhöii*, Hance, which is evergreen: *lvs.* ovate: fr. black, rather bitter. China. G.C. III. 51:166, under this name, appears to represent *R. hupehensis*.

BB. *Infl. variously paniculate or thyrsoid, the peduncles mostly fascicled (except perhaps in No. 20)*.

C. *Lobes of lvs. none or usually not prominent (partial exception in No. 19), the lvs. not mallow-like*.

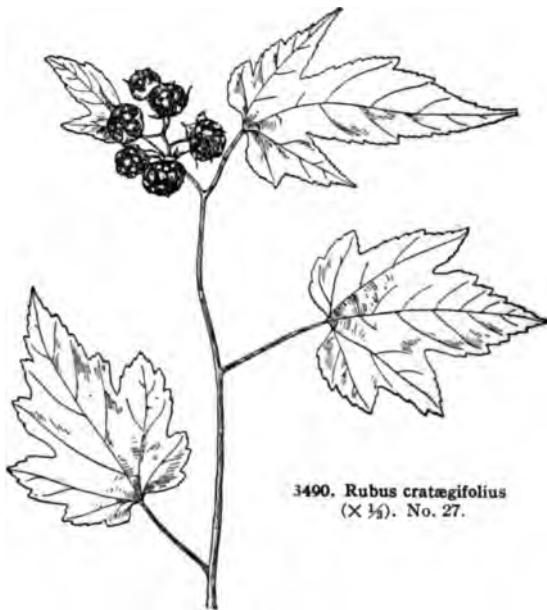
16. *chroosépalus*, Focke. Strong-growing shrub, with slender sts. which bear few spines: *lvs.* simple, cordate-ovate, 4 in. long and nearly as broad, linden-like, glabrous above, tomentose beneath: fls. in large loose panicles, apetalous, the reflexed sepals colored inside: fr. small, black. Cent. China. G.C. III. 51:166.—Advertised abroad; evergreen probably in mild climates, but sometimes described as deciduous. Useful on posts and pergolas for its habit and foliage.

17. *ichangensis*, Hemsl. & Kuntze (*R. eugenius*, Focke). Sts. long and slender, with few small prickles, evergreen: *lvs.* simple (the older ones sometimes more or less 3-lobed), broad-lanceolate, cordate at base, 3–4 in. long, light green on both surfaces, remotely toothed, long-petioled: fls. very small, in small panicles: fr. small, red, of good flavor. Cent. and W. China, to

7,000 ft. altitude. G.C. III. 48:275.—The *lvs.* have a metallic luster.

18. *Parkeri*, Hance. Slender evergreen, with long scandent softly glandular-hairy sts. which bear short curved spines: *lvs.* simple, broad-lanceolate or ovate-lanceolate, 3–5 in. long, cordate at base, irregular or angled on the sides, rugose, dark green above, velvety-pubescent beneath: fr. black. China. G.C. III. 51:166.

19. *Lambertianus*, Ser. Sts. long and slender, quadrangular, with few hooked spines, evergreen: *lvs.* simple, 3–5-lobed and more or less angled, 3–4 in. long, bright green but becoming colored in autumn, glabrous above, slightly hairy and light green beneath: fls. small, whitish, in terminal clusters: fr. red, and apparently sometimes yellow. China. G.C. III. 48:276; 51:166. Var. *gläber*, Bean. Differs in having terete sts., uniformly yellow fr., and *lvs.* and sts. glabrous or nearly so.



3490. *Rubus crataegifolius*
($\times \frac{1}{2}$). No. 27.

CC. *Lobes of lvs. usually prominent, and the lvs. mallow-like*.

D. *Sts. herbaceous or only half-shrubby*.

20. *irenæus*, Focke. Unarmed or with very small prickles, with slender creeping sts., evergreen: *lvs.* simple, nearly orbicular, 5 or 6 in. either way, cordate at base, slightly 3–5-lobed, white-tomentose and rusty along the nerves beneath, glabrous and metallic green above: fls. $\frac{1}{2}$ in. or more across, the petals roundish, white, exceeding the sepals: fr. yellow. Cent. China, 4,000–8,000 ft. altitude.—Probably useful in mild climates and moist places for covering slopes.

DD. *Sts. shrubby*.

21. *omeiensis*, Rolfe (*R. clémens*, Focke). Unarmed shrub with branches arching and 10–20 ft. long: *lvs.* palmately lobed, 4–5 in. across, hairy beneath: fls. small, rose-colored, in long and narrow panicles: fr. black. It makes long straggling growths lying on the ground and rooting freely: unarmed: *lvs.* shortly 5-lobed or obscurely 7-lobed, 7–9 in. across either way, glabrous above and hoary beneath: fls. small, with purplish petals. W. China; bears the name of Mt. Omei.

22. *flagelliflorus*, Focke (*R. flagelliformis*, Hort., not Smith). Evergreen or nearly so, of attractive habit, 8 ft. or more, the sts. and under surface of *lvs.* duntomentose, the spines few: *lvs.* simple, cordate, acumi-

nate, irregularly serrate, 4-5 in. long, deep metallic green on upper surface: fls. white, on growths of 6-8 in. long: fr. medium in size, glossy black. Cent. and W. China, 4,000-6,000 ft. R.B. 33, p. 360.—Useful on posts and pergolas.

23. *moluccanus*, Linn. A large raspberry-like plant in many forms, common in India and Malaya, and to be expected as an intro. plant in many warm countries. Very robust, the tomentose canes and branches red-hairy and with short curved scattered prickles: lvs. simple, very variable, large, usually hairy, gray- or yellow-woolly beneath, mostly broad-ovate or orbicular and deep-cordate, shallowly 3-5-lobed, irregularly serrate: fls. white, in contracted terminal clusters: fr. in shades of red, succulent. Gn. 63, p. 408. G.M. 46, p. 323. —Probably not in the American trade.



3491. *Rubus spectabilis* of western America.—The salmonberry. (No. 32.)

24. *reflexus*, Ker. Tall stout climber sometimes confused with *R. moluccanus*: prickles few and scattered: young growth, petioles, and under surface of lvs. bearing cinnamon-colored pubescence: lvs. simple but sometimes prominently 3-5-lobed, broad-ovate or ovate-oblong in outline, base cordate, margins toothed, prominently nerved beneath, the terminal lobe long: fls. white or pink, $\frac{3}{4}$ in. or less diam., nearly sessile in small few-fl'd. declined clusters: fr. small, globular, red-purple or black. China. B.R. 461. B.M. 7716. Var. *pictus*, W. Wats., has the lvs. velvety green, and gray-variegated above and soft pale cinnamon-brown beneath: handsome. G.C. III. 33:309 (as *R. moluccanus*). R.B. 29:237.

Section VI. IDEOBATUS. Raspberries.

A. Lvs. simple, often 3-lobed on strong shoots.

25. *corchorifolius*, Linn. f. Nearly or quite erect, 4-6 ft., the terete sts. downy and bearing small straight spines: lvs. simple, cordate-ovate, mostly 3-lobed on the verdurous shoots, 4-7 in. long, dull green above and pubescent beneath, the margins coarsely toothed, midrib and petiole with hooked prickles: fls. white, solitary, on short lateral twigs: fr. bright red, large, said to be excellent in quality. Cent. and W. China, to 7,000 ft. altitude. Japan. G.C. III. 51:149.—There are several forms or very closely related species.

26. *palmatus*, Thunb. Spreading, often slender-stemmed plant growing 4-5 ft. tall, with many short, but stout nearly straight spines: lvs. rather small, 2-3 in. long as a rule, narrow-ovate-acuminate or sometimes nearly triangular-ovate-acuminate, rather deeply 3-5-lobed and the middle lobe long and acuminate, the margins very sharp-serrate: fls. white, nearly or quite $\frac{3}{4}$ in. across, with broadly ovate petals: fr. small (red?), of little value. China, Japan. B.M. 7801.—Sparingly intro. as an ornamental plant, but little known here. The Mayberry, intro. by Luther Burbank, is said to be a hybrid between this species and the Cuthbert raspberry (*R. strigosus*). The Mayberry is described as producing a large yellow edible berry, ripening in advance of the strawberry. *R. palmatus* is doubtfully referable to *R. microphyllus*, Linn. f.

27. *crataegifolius*, Bunge. Fig. 3490. Strong, erect or diffuse much-spreading plant (3-5 ft.), with terete reddish glabrous canes that bear few and small straight spines: lvs. oblong-ovate to cordate-ovate, acuminate, 3-5-lobed, and the margin coarsely serrate and notched: fls. white, in small clusters terminating slender leafy shoots, about $\frac{1}{2}$ in. across: fr. small, orange-red, of no value. China, Japan.—An excellent plant for holding banks and for covering waste places, and giving fine deep reds in the fall. Perfectly hardy in Cent. N. Y.

28. *Savatieri*, Bailey (*R. morifolius*, Sieb.; Franch & Savat. Enum. Pl. Jap., 1875, not Muell., 1858. *R. crataegifolius* var. *morifolius*, Focke). Differs from *R. crataegifolius* by its more numerous and stronger prickles, the lvs. villous beneath and deeply cordate at base, shorter petioles and shorter and thicker pedicels. Japan.—Offered by dealers in Japanese plants, who speak of its pretty fr. ripening in July.

29. *trianthus*, Focke. Wide-spreading deciduous shrub, glabrous: sts. erect, and much branched, blue-white, prickly, 4-6 ft.: lvs. simple, more or less 3-lobed, 3-6 in. long, ovate to triangular: fls. pink-white, small: fr. dark red, of 10-30 carpels. Cent. China.

30. *conduplicatus*, Duthie, perhaps the same as *R. trianthus*, but described as differing in the pale green (not white) under surfaces of lvs., smaller fls., prickles on st. stronger and more curved. China.—A scandent glandless shrub, with simple petiolate lvs. which are ovate-lanceolate and acuminate and sometimes obscurely 3-lobed, the margins unequally incised-serrate: fls. 3-4, terminal, white.

31. *Koehneanus*, Focke (*R. incisus*, Hort., not Thunb. *R. morifolius*, Hort., not Sieb.). Nearly erect shrub, 3-4 ft. high, the branches with purplish bloom and unarmed or sparingly prickly: lvs. simple, varying from almost entire to 3-5-lobed, 5 in. or less long, and nearly as broad, mostly deep-cordate at base, green above and white-pubescent beneath, the lobes more or less acute, petioles somewhat prickly: fls. few, in loose terminal corymbs, white, the petals about $\frac{1}{2}$ in. long: fr. small and globose, orange. Japan. B.M. 8246. Gt. 53, p. 555 (as *R. incisus*).

AA. Lvs. ternately compound, running to 5-foliolate forms, often on the pedate order.

B. Fls. large, solitary or few together.

32. *spectabilis*, Pursh (*Parm. spectabilis*, Greene). SALMONBERRY. Fig. 3491. Strong-growing, reaching 5-15 ft., glabrous: spines few or often none, weak: lvs. of 3 ovate-acuminate lfts., which are doubly serrate-toothed and sometimes indistinctly lobed, long-stalked, thin, glabrous or becoming so beneath: fls. solitary or in 2's, large, red or purple: fr. large, somewhat conical, salmon-color or wine-red, edible, the drupelets bearing the persistent styles. Calif. and Idaho to Alaska. B.R. 1424. L.B.C. 17:1602. F.S. 21:2260. Mn. 4, p. 57.—Sometimes cult. for its showy fls. and frs. Canes perennial. Var. *Menziesii*, Wats. (*R. franciscanus*, Rydb.), has lvs. densely pubescent or silky underneath.

BB. *Fls. medium-sized or small, mostly clustered.*

c. *Plant profusely red-hairy.*

33. *phoenicolasius*, Maxim. WINEBERRY. Fig. 3492. Canes long and recurving, furnished with straight, weak prickles and densely clothed with red-brown glandular hairs, prop. by "tips:" lfts. usually 3, broad-ovate to round-ovate, apiculate-toothed and sometimes indistinctly lobed at top, white-tomentose beneath: fls. in dense, small, shaggy-haired clusters which spring from the uppermost axils and form a large, loose, leafy panicle; petals shorter than the long, bristly calyx-lobes, the latter enlarging after flowering and inclosing the growing frs. in a bur but spreading apart as the fr. matures: fr. usually small and soft, cherry-red, acid or usually insipid. Japan and China. B.M. 6479. G.C. II. 26:365; III. 11:269; 28:137. J.H. III. 29:210. Gt. 52, p. 565. G. 19:235. A.G. 12:205; 15:435. Gng. 3:263.—Interesting as an ornamental plant, and also recommended for its fr. In the N. it often kills to the ground, but the strong young recurving canes and white-bottomed foliage make it a handsome plant. Sparingly run wild in the E. U. S.

34. *adenophorus*, Rolfe (*R. sagatus*, Focke). Resembles *R. phaeocolasius*: sts. stout, with short red prickles, the exposed parts dark red, densely covered, as are the sepals and petioles, with purple stalked glands: lvs. ternate or the upper ones simple, the lfts. unequal (rarely 5), the terminal largest and cordate-ovate, the lateral subsessile, all dull green above, hairy on both sides: fls. 6–10, in short terminal clusters, rose-colored, the broadly clawed petals about $\frac{1}{4}$ in. long: fr. about $\frac{1}{2}$ in. across, edible, the drupelets red with black tips. China.—The erect red sts. are ornamental in winter and the foliage is ornamental in summer.

35. *ellipticus*, Smith (*R. flavus*, Hamilt. *R. Gowreep-hul*, Roxbg.). Fig. 3493. Tall and erect or nearly so (6–10 ft.), the canes stout and densely beset with straight red-brown or crimson hairs and bearing a few stout, short, nearly straight prickles: lfts. 3, the terminal one much the largest, ovate to orbicular-ovate, not lobed, evenly doubly serrate, thickish, soft pubescent and strongly veined and prickly on the midrib beneath: fls. white, $\frac{1}{2}$ in. or less across, in small, many-fl. clusters: berry the size of a common raspberry, yellow,

of good quality. Himalayas.—Grown in S. Fla., where it is said to be the only raspberry that perfects its fr. Advertised in Calif. as Golden Evergreen raspberry, and recommended for pergolas and covering sheds. Naturalized in Jamaica.



3493. *Rubus ellipticus*. A yellow-fruited species from the Himalayas ($\times \frac{1}{2}$). No. 35.

cc. *Plant not red-hairy all over.*

D. *Fr. red or reddish at maturity (not described in Nos. 39, 42), sometimes golden (running into yellow and white forms).*

E. *Infl. usually 1- to 6-fl.*

36. *macilentus*, Camb. Shrub, to 5 ft., the branches bearing strong straight or hooked prickles, the plant glandless and nearly glabrous: lvs. glabrous, with many hooked prickles, the lfts. 3, of which the terminal one is 2 in. or less long and ovate-oblong, the lateral ones small, all doubly toothed: fls. white, usually 3 together on end of short lateral growths: fr. orange, yellow, or red, glabrous, inclosed in the calyx. Himalayan region.

37. *lasiostylus*, Focke. A species apparently of variable forms, having bluish white bristly strong arching sts.: lvs. pinnate, small, silvery white beneath, the lfts. 3–5 and coarsely unequally double-serrate and sometimes 3-lobed: fls. magenta-red, of good size, the petals erect and clawed: fr. rose-color but woolly, sweet but said to be useless for eating. China. G.C. III. 51:167. G. 28:631.

38. *biflorus*, Hamilt. Strong shrub prized in cult. for its glaucous-white canes: reaches 8–10 ft., with arching canes that bear stout, recurved prickles: lfts. 3–5, ovate or oval, incise-serrate, whitish beneath: fls. large and white, 1–3 on drooping pedicels: berry golden yellow or amber-colored, size of the common raspberry, the calyx at first erect, but finally spreading. Temp. Himalaya. B.M. 4678. R.H. 1855:5. Gn. 54, p. 456. Var. *quinqueflorus*, Focke. A striking plant with sts. reaching 12 ft. high and 4–5 in. circum. at base, covered with a waxy white bloom and therefore very showy, the spines stiff and $\frac{1}{2}$ in. long: pinnate lvs. about 1 ft. long, the lfts. about 5 and white beneath: panicles terminal and axillary and about 5-fl., the fls. white and $\frac{3}{4}$ in. across: fr. golden yellow, good. W. China. Gn. 76, p. 624.—A promising fr.-bearing as well as ornamental plant.

39. *Wilsonii*, Duthie. Scandent shrub with terete very spiny brown-purple glaucescent sts., the branches quadrangular and red-purple and more or less winged between the nodes: lvs. pinnate, of 3–5 ovate more or less cordate strongly double serrate lfts. which are glabrous and deep green above and paler beneath and sparsely prickly on the ribs underneath: fls. purple, in axillary and terminal few-fl. fascicles (terminal clusters 4–5-fl., axillary 2–3-fl.), the petals about $\frac{1}{2}$ in. broad and long. Cent. China.

EE. *Infl. many-fl., mostly clustered, dense or aggregated.*

40. *innominatus*, S. Moore. Raspberry-like in appearance, with strong upright very soft-pubescent and sparingly prickly sts. 6–8 ft. high: lvs. pinnate,



3492. *Rubus phoenicolasius* ($\times \frac{1}{2}$). No. 33.

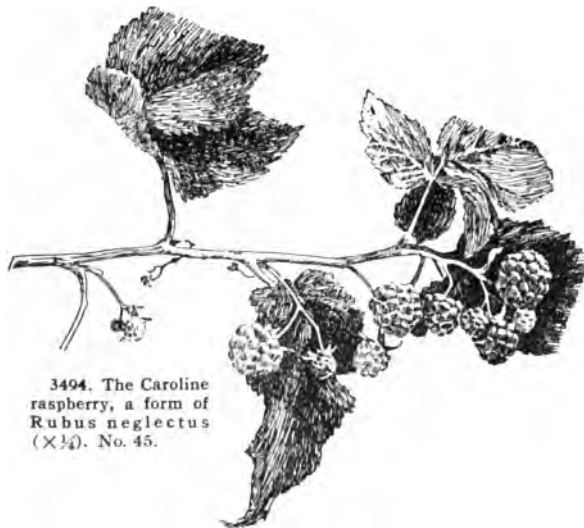
large (often 9 in. long), dark green, grayish white beneath and thickly covered with glands, with 3 or 5 (usually 3) ovate lfts., the terminal one much larger than the others and often 3-lobed: fls. small, pink, in panicles 18 in. long in Sept.: fr. orange-red, edible. Cent. and W. China. G.C. III. 38:291. R.B. 33, p. 360.—*R. Kuntzeanus*, Hemsl., is distinguished by its glandless lvs.; perhaps not specifically separate; the plants in cult. as *R. innominatus* apparently belong to this species.

41. *telédapos*, Focke. Arching or procumbent, with few strong incurved prickles: lvs. ternate or somewhat quinate, opaque above but densely pubescent when young, white-tomentose beneath; lateral lfts. obliquely ovate-lanceolate, acute, coarsely serrate; terminal lft. ovate or ovate-lanceolate, acuminate, sometimes obscurely lobed, coarsely incised-serrate above: fls. many, in a leafless terminal raceme or in few-fl. axillary clusters, rose-colored or purple: fr. red. W. China.

42. *mesogæus*, Focke. Sts. weak or scandent, densely tomentose-pubescent, with small weak prickles: lvs. ternate, slender-petioled; lfts. rhomboid-elliptic or angled-ovate or oblique-ovate, all unequally coarsely serrate, the terminal stalked, broad-ovate, sometimes lobed-dentate: fls. several to many, small, white or rose-colored, the petals obovate and clawed: fr. small, red(?). China.

43. *idæus*, Linn. EUROPEAN RASPBERRY. An erect, mostly stiff grower, prop. by suckers, the canes light-colored and bearing nearly straight slender prickles: lfts. ovate, white beneath, irregularly toothed and notched, usually somewhat plicate or wrinkled: fl.-clusters mostly long and interrupted, most of the peduncles dividing into 2 or 3 pedicels, the pedicels, as also the flowering shoots, petioles, and midribs, finely pubescent, but not glandular, and sparsely furnished with firm recurved prickles: fls. small, white; calyx pubescent: fr. oblong or conical, dark red, yellow or whitish, produced more or less continuously throughout the season. Eu. and Asia.—Named for Mt. Ida, in Greece. Early intro. into this country, but now nearly driven from cult. by the hardier native species. The Antwerp, Fontenay, and Fastolf belong here. *Rubus idæus* is not known to be native to N. Amer., but it is said to be sparingly escaped from cult.

44. *strigōsus*, Michx. (*R. idæus*, Linn., var. *strigōsus*, Maxim. *R. idæus*, subsp. *strigōsus*, Focke). RED RASPBERRY. Fig. 3355, p. 2913. Much like the last, but distinguished by a more slender and open habit,



3494. The Caroline raspberry, a form of *Rubus neglectus* (× $\frac{1}{4}$). No. 45.

stiff prickles on the bearing canes which are brown and somewhat glaucous, thinner leaves, and gland-tipped hairs or bristles upon the flowering shoots, petioles, and calyx, the latter less pubescent or hirsute: fl.-clusters more open or scattered: fr. bright light red, or rarely yellow or whitish, not produced continuously. Widely spread in the northern states as far west as Missouri, also in the mountains to Ariz. and northward to Alaska, extending farther north than the Blackcap; also in Asia.—Under cult. the glandular hairs usually disappear. The light red garden berries, like Cuthbert, belong here. Var. *albus*, Fuller, has amber-white frs.

This plant belongs to a variable group, and other species have been separated from it, as: *R. carolinianus*, Rydb., from N. C., with young sts. puberulent and densely retrorsely glandular-hispid; *R. Egglestonii*, Blanch. (*R. idæus* var. *anomalus*, Fern.), from Vt., perhaps an aberrant form, with lvs. of floral branches mostly simple and reniform and somewhat rounded-3-lobed; and others.

45. *neglectus*, Peck. PURPLE-CANE RASPBERRIES. Fig. 3494. A large and variable race of hybrids between *R. strigosus* and *R. occidentalis* occurs both naturally (*Rubus neglectus*, Peck, 22d Rep. Reg. N. Y. State Univ. 53, 1869) and in the garden (Bailey, Amer. Gard. 11:721, 1890). These plants prop. either by "tips" or suckers, usually by the latter. The fl.-clusters are open and straggling, and the fr. ranges in color from yellow to purple. As a rule, the fr. is aggregated at the end of the cluster, but is scattering below. The Purple-Cane type of raspberry belongs here. Prominent varieties are Shaffer, Philadelphia (now nearly out of cult.), Gladstone, and probably Caroline.

DD. Fr. black at maturity (yellow-fruited forms are known).

46. *occidentalis*, Linn. COMMON BLACKCAP. Figs. 3495, 3496. Strong, erect bush, the canes finally recurving and rooting at the tips, furnished with straight spines, glaucous, not bristly; lfts. broadly ovate, dull green above and white beneath, finely and sharply serrate and notched, the petioles usually bearing short prickles: fls. in small, dense, prickly clusters with sometimes a few scattering pedicels, the petals shorter than the long-pointed whitish woolly sepals: fr. rather small, hemispherical, firm or even hard, black or occasionally amber-white, dry and sweet. Plentiful in fields and clearings in the northeastern states and Canada to Ore. and Brit. Col. and southward to Ga. in the mountains, and to Mo.—In cult. known in many forms, as Ohio, Gregg, etc. Var. *pallidus*, Bailey, has amber-yellow fr.; sometimes found in the wild.

47. *leucodermis*, Douglas (*R. occidentalis* var. *leucodermis*, Card). Branches often yellow-tinged: lfts. more coarsely dentate-serrate, sometimes nearly incise-serrate, more gradually acuminate, yellowish green above, the prickles strong and more hooked and those of the infl. flattened laterally: fr. reddish black or black. Rocky Mts. and west to the Coast Range.

AAA. Lvs. long-pinnate, usually with 3 or more pairs of narrow lfts.

48. *rosæfolius*, Smith (*R. floribundus* and *R. sinensis*, Hort. *R. rosaeflorus*, Roxbg.). Erect and tall-growing,



3495. *Rubus occidentalis*. The original of the cultivated black raspberries (× $\frac{1}{4}$). No. 46.

evergreen in warm countries, glabrous or somewhat pubescent-hirsute: lvs. odd-pinnate, the lateral lfts. 2-7 pairs, all the lfts. ovate-lanceolate or lance-oblong, acuminate, strongly many-veined and very sharp-serrate, more or less silky-hairy beneath: fls. solitary or in few-fl. clusters, white, $1\frac{1}{2}$ -2 in. across, showy: fr.



3496. Gregg raspberry, a cultivated form of *Rubus occidentalis* (X $\frac{1}{4}$). No. 46.

erect, bright red, long thimble-shaped, usually about 1-1 $\frac{1}{2}$ in. high, very showy, edible but insipid. Widely distributed in tropical countries, but native to the Himalayan region and eastward to China and Japan; naturalized in W. Indies. B.M. 6970. F.S. 17:1714. A.G. 20:82, 87. Var. *coronarius*, Sims (*R. grandiflorus*, Hort.), is a double form, sometimes cult. as the "Brier Rose" and "Bridal Rose" (B.M. 1783. G.C. II. 11:77. G.Z. 26, p. 266). The double-fl. form is often grown under glass and in pots.

49. *illecebrosus*, Focke (*R. sorbifolius*, Hort., not Maxim.). STRAWBERRY-RASPBERRY, Figs. 3497, 3498, from Japan, is a dwarf glabrous but prickly undershrub with pretty pinnate foliage, and white fls. $1\frac{1}{4}$ in. across, and scarlet fr. Gn. 64, p. 412. A.G. 24:603. A beautiful plant and worthy of general cult. In the N. it usually kills to the ground each winter, but it throws up shoots 2-4 ft., and these bloom from summer until frost, usually ripening fr. at the same time. The fr. has some value for eating, but it is probable that it will never be greatly developed in this direction. *R. illecebrosus* is suckering: sts. angular, glabrous, prickly: lfts. 5-7, oblong-lanceolate, acuminate, duplicate serrate, pilose on the veins beneath, otherwise nearly glabrous: fls. terminal and axillary, solitary or few, bracted. How much of the cult. material belongs to this species and to No. 48 is to be determined.

50. *coreanus*, Miq. Of upright or erect growth, with straight prickles on the sts. and hooked prickles on the petioles, self-supporting, 6-7 ft. or more high, the sts. hoary, bluish white and the young growths dark brown: lvs. pinnate, 7-9 in. long, usually of 7 or 9 ovate serrate pointed light green lfts.: fls. rose or purple, in large terminal panicles: fr. said to be of no value. China, Korea. G.C. III. 51:149.

51. *amabilis*, Focke. Shrub, 6 ft., slightly prickly or unarmed above: lvs. pinnate, with about 9 ovate or ovate-lanceolate, deeply double-serrate lfts. 2 in. or less long, the petiole and rachis weak-prickly, the stipules small and linear: fls. solitary, terminal, large (about 2 in. across), white: fr. large and red, of good flavor. W. China.

52. *flosculdeus*, Focke. Erect, about 7 ft., the dark brown sts. bearing stiff prickles: lvs. pinnate, silvery white beneath, with 5-7 lfts. which are distant, lanceolate, or narrowly rhomb-lanceolate, serrate, white-tomentose beneath: fls. about 12, small, pale purple, in a panicle, appearing in Sept.: fr. small (size of a pea), dark red becoming black. Cent. and W. China, 4,000-6,000 ft.

53. *thibetanus*, Franch. (*R. Veitchii*, Rolfe). A curious deciduous rubus, said by Focke to represent perhaps the type of a well-marked section in the genus: shrub with terete prickly branches and graceful fern-like foliage: sts. at first erect, but arching with age, blue-white: lvs. 6-9 in. long, pinnate, with 5-11 elliptic or ovate coarsely toothed lfts., puberulous or silky-hairy above and white beneath, the terminal lft. ovate-lanceolate or rhomboid and 2-3 in. long and sometimes almost pinnatifid: fls. rose-purple, in terminal few-fl. prickly and pubescent panicles, the orbicular-obovate petals small: fr. globose, red or blue-black, of moderate size. W. China. G.C. III. 51:149.

54. *niveus*, Thunb. Very strong-growing, the sts. reaching 12 ft. and 3 in. circum. with many stiff brown hairs and small spines, arching at the ends: lvs. pinnate, with 3-11 lfts. variable in shape but mostly rhomb-oblong or ovate-oblong, coarsely serrate, whitish-tomentose beneath, the lateral ones scarcely stalked: fls. small, white, many in terminal and axillary panicles: fr. dull black, of medium size. Cent. and W. China, 3,000-8,000 ft. altitude.

55. *Giraldianus*, Focke. Said to be an elegant bush reaching 8-9 ft. in height, the sts. white, branching and gracefully curving above, terete, glabrous, prickly: lfts. usually 7, the terminal ovate-lanceolate, the lateral oblong-lanceolate, unequally coarsely serrate, glabrous above, tomentose beneath: fls. in terminal panicles, 4-5 in. long, small, white: fr. black. N. and Cent. China. Gn. 76, p. 624. G.C. III. 51:147 (as an unnamed species).

Section VII. EUBATUS. Blackberries and Dewberries.

A. *Blackberries*: plant usually erect or essentially so (strong canes often recurving and very long ones often repent).

B. *Species exotic, with mostly perennial canes, and fls. usually borne on the ends of the main shoots.*

56. *thyrsanthus*, Focke. A vigorous species, with suberect or decumbent canes which are prostrate when very long, the strong prolonged sts. angled and

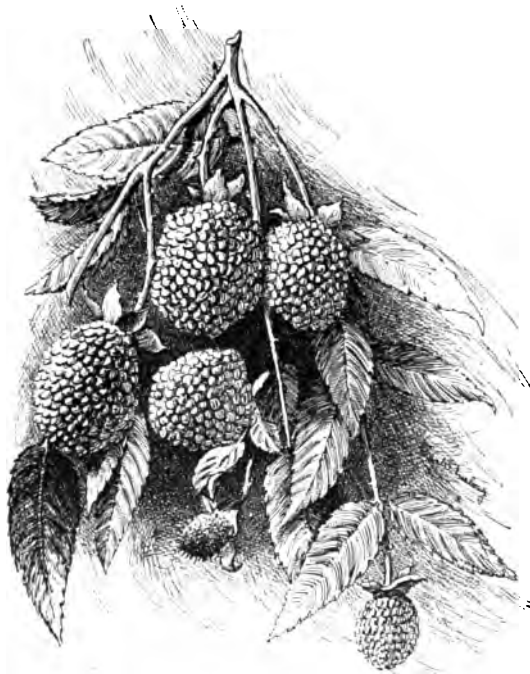


3497. *Rubus illecebrosus*. One of the best flowering rubuses. (No. 49.)

grooved, thorny with flattened declined or curved prickles, mostly thinly hairy or pubescent: petioles and midribs recurved prickly; lfts. 3 or 5, thick, green above and white-tomentose beneath, round-elliptic or round-ovate, the terminal one broad-elliptic or ovate, abruptly pointed, sharply and mostly doubly serrate-dentate: infl. thyrsoid-paniculate, narrow, short or elongated, sometimes compound, densely pubescent or tomentose, leafy; fls. about medium size, white, the small reflexed sepals white-tomentose: fr. black.—Germany, and probably scattered by cult., regarded by Focke as one form of the collective species *R. thyrsoides*, Wimm. Inserted here because the plant grown in this country as the Himalaya berry (p. 1492) is perhaps referable to it.

57. *Linkianus*, Ser. St. angled with many very strong and sharp hooked prickles and mostly finely pubescent: petioles and midribs strongly prickly; lfts. 3-5, oval or elliptic and acute, strongly and mostly doubly toothed, green and nearly or quite glabrous above but white-tomentose beneath: infl. short-paniculate, beset with strong prickles and often more or less leafy, pubescent or tomentose: fls. mostly double, white, the petals obovate and about $\frac{1}{8}$ – $\frac{1}{2}$ in. long: fr. black.—Species founded on garden specimens, the native country being unknown. It is said to be sometimes escaped from cult. and occurs now and then on ballast. A similar plant (not double-fl.) occurs under apparently feral conditions from Md. to Fla., and from this race the Tree blackberry or Topsy, a very thorny variety intro. some years ago as a fr.-plant, seems to have come. This American plant has been confused with *R. cuneifolius*, but differs in its very different foliage. This group is much in need of careful study; Focke regards it as one of the forms of *R. thyrsanthus*. The plant sometimes grown as *R. fruticosus flore alba-plena* and *R. spectabilis*, Hort. (not Pursh), probably belongs here or with the following.

58. *ulmifolius*, Schott (*R. fruticosus flore roseo-plena*, Hort. *R. bellidiflorus*, C. Koch). Sts. or canes



3498. *Rubus illecebrosus*. Sometimes known as strawberry-raspberry. ($\times \frac{1}{2}$)

curving-prostrate or scandent; prickles stout, compressed, dilated at base, straight or on the branches deflexed or falcate: lvs. of 3 or 5 lfts., the petiole armed, stipules linear; lfts. coriaceous, small, unequally sharply serrate, glabrous and somewhat rugose above, tomentose beneath, the terminal one obovate or cuneate-obovate to nearly orbicular: infl. elongated, leafy at base, tomentose and prickly; fls. of medium size, with



3499. *Rubus laciniatus*
($\times \frac{1}{2}$). No. 59.

reflexed unarmed tomentose sepals and red broad-obovate or suborbicular petals, sometimes double: fr. black. Eu.; sometimes grown for its evergreen foliage and in the form with double red or pink fls.

59. *laciniatus*, Willd. (*R. fruticosus* var. *laciniatus*, Hort.). CUT-LEAVED or EVERGREEN BLACKBERRY. Fig. 3499. A tall, straggling bush with permanent or perennial canes in mild climates, and lvs. more or less evergreen, the sts. provided with recurved prickles: lfts. 3, broadly ovate in general outline, cut into several or many oblong or almost linear sharply toothed divisions, the ribs prickly below and the petioles strongly so: fls. in terminal panicles, white or bluish, the calyx and pedicels pubescent or even tomentose: fr. usually thimble-shaped, late, black, often excellent. Gn. 21, p. 57; 45, p. 78. G.M. 49:765.—This blackberry is probably native to Eu., where it has been long known in gardens. It is apparently only a cut-lvd. form of the European *R. vulgaris*, Weihe & Nees. It is now widely scattered, and seems to thrive particularly well in Hawaii and other Pacific islands and on the Pacific slope. By some it is supposed to be native to the South Sea Is. (see Bull. 64, Utah Exp. Sta.). It is probable that the plant has been intro. into the W. from those sources, but such fact does not prove its original nativity. It has aroused considerable attention in Ore. and other parts of the W., and has been known as the Oregon Everbearing blackberry. In mild climates the lower parts of the canes often live from year to year until they become as thick as one's wrist; and in such climates the lvs. persist for the greater part of the winter. The plant has long been grown for ornament in the eastern states, but it has not attracted attention as a fr.-plant in this region. The fruits are of fair size and quality, and ripen from midsummer or late summer to Oct. The plant is a good ornamental subject, although it is likely to cause trouble by sprouting at the root.

BB. *Species-group of native American origin, with essentially biennial canes: fl.-clusters from lateral shoots as well as terminal.*

60. Cultivated American blackberry. A large group of confused or at least undetermined origin, developed within 50 to 75 years from native American species: mostly erect and thorny plants, the canes commonly tall and more or less recurving at the ends: lfts. 3-5, from ovate-acuminate to rarely nearly

broad-lanceolate, usually pubescent and hairy on the ribs beneath: infl. on elongated raceme-like cluster of which the center or terminal fl. is commonly the oldest (the long-cluster blackberries), or nearly as broad as long, due both to shorter axis and longer lower pedicels (short-cluster blackberries), sometimes with small lvs. intermixed (leafy-cluster blackberries), the rachis and pedicels usually glandular-pubescent but in some forms



3500. *Rubus allegheniensis* ($\times \frac{1}{4}$). No. 60.

nearly or quite glabrous: fr. various, from long and thimble-shaped to ovoid or nearly globular.—The more or less well-recognized wild native species-types, variously defined and re-defined, from which some or all of the prevailing pomological blackberries are probably derived, are as follows: *R. argutus*, Link, an erect or stout species with very prickly stiff sts., lvs. relatively small or medium-sized with short-pointed lfcs. and thorny stalks and ribs, mostly not glandular short infl., a prevailing group widely distributed from Canada to N. C. and Iowa; with this group are probably to be associated *R. annicolus*, *R. Andrewsianus*, *R. floricomus*, Blanchard, and perhaps *R. pergratus* and *R. orarius*, Blanchard.—*R. floridus*, Tratt., a tall species with branches often decumbent or strongly recurving and stout curved prickles: lfcs. mostly narrow and acuminate, somewhat pubescent beneath: infl. loose and leafy, with few fls.: fr. elongated, the drupelets small. Va., south and west. With this, *R. betulifolius*, Small, and *R. lucidus*, Rydb., are probably to be associated.—*R. frondosus*, Bigel., of medium height, mostly erect but sometimes recurving, the prickles straight only slightly curved: lfcs. broad, becoming glabrate above, velvety-pubescent beneath: infl. short, villous, with a few simple lvs. or bracts. Canada to Va. and Kans. To be associated with this group are *R. recurvans*, *R. arundelanus*, *R. philadelphicus*, *R. Rossbergianus*, Blanchard, *R. Brainerdii*, Rydb.—*R. allegheniensis*, Porter (Fig. 3500; also Fig. 578, Vol. I). Of medium height, erect but more

or less recurving, the mostly stout prickles moderately curved: lfcs. ovate, often cordate, glandular-pubescent beneath: infl. mostly elongated and not leafy, glandular-hairy. Canada to N. C. and Ill. With this group are to be associated *R. nigrobaccus*, Bailey, *R. sativus*, Brainerd, *R. glandicaulis*, Blanchard.

The wild thornless blackberry, *R. canadensis*, Linn. (*R. Millspaughii*, Brit.), is a tall mostly weak-caned entirely thornless species apparently not represented in domestication, the frequent so-called thornless forms of cult. blackberries being apparently unarmed offshoots of normally thorny kinds; this readily distinguished species, with narrow thin mostly glabrous lfcs., is native in Canada and the northern states and in the higher lands to N. C.; here are to be associated *R. Randii*, Rydb., and perhaps *R. elegantulus* and *R. amicalis*, Blanchard.

The sand blackberry, *R. cuneifolius*, Pursh, growing in dry fields from Conn. to Fla. and La., appears not to be in cult. or to have contributed to the admixture of the garden blackberries. (Fig. 581, Vol. I.) It is a stiff and thorny plant, usually not over 3–4 ft. tall, the prickles many, mostly hooked, and very strong, the young growths white-tomentose: lfcs. on bearing canes mostly small and thick, wedge-oblong to wedge-obovate, obtuse or nearly so, densely white-tomentose beneath, the margins sharp-toothed: fl.-clusters 4–10-fl., short, more or less leafy and thorny, the fl.-buds globular and pubescent: fr. medium in size, firm, often sweet and good. See discussion under *R. Linkianus*, No. 57.

AA. Dewberries: plant trailing or strongly decumbent (often trained to stakes or on trellises under cult.).

B. The pomological dewberries of E. American origin.

61. Cultivated American dewberry. A variable group of American origin, from the native species: trailing or prostrate plants, the weak slender canes lying on the ground or sometimes making low mounds, mostly prickly or thorny: lfcs. usually 3: infl. short and mostly interrupted or leafy, or the fls. axillary, pubescent or glabrous: fr. blackberry-like.—The native sources of the dewberries are to be sought in the following more or less marked species-segregations; *R. procumbens*, Muhl. (*R. villosus*, Ait., not Thunb.) (Figs. 3501, 3502), of the northeastern states and south to Va., is the prevailing dewberry of open fields away from the Coastal Plain, with canes usually several feet long and usually bearing stout recurved prickles: lfcs. usually narrowed at the base, nearly or quite glabrous: fls. in the upper axils. Var. *roribaccus* (*R. villosus* var. *roribaccus*, Bailey) is the Lucretia dewberry type.—*R. invisus*, Brit. (Figs. 3503, 3504; also Fig. 1250, Vol. II). Probably has the range of *R. procumbens*: canes strong and terete, somewhat ascending and often making mounds or piles of canes and herbage, not very prickly: lfcs. large, those on the sterile shoots with large simple serratures: infl. dichotomous. *R. geophi-*



3501. *Rubus procumbens*, a common northern wild dewberry ($\times \frac{1}{4}$). No. 61.

3502. *Rubus procumbens*, fruiting branch ($\times \frac{1}{4}$). No. 61.

lus, Blanchard, is to be placed in this group.—*R. Baileyanus*, Brit. (*R. villosus* var. *humifusus*, Torr. & Gray). More slender, little prickly: lfts. mostly broad at base, pubescent beneath: lvs. or bracts in the infl. simple. Northeastern states. *R. arenicolus*, Blanchard, is probably to be associated with this.—*R. Enslenii*, Tratt, Nantucket and L. I. southward, on the Coastal Plain and perhaps westward, is a soft-caned weak plant with small loose black fr. that is probably little if at all involved in the origin of the horticultural dewberries.

BB. *The swamp dewberry or running blackberry.*

62. *hispidus*, Linn. (*R. obovatis*, Michx. *R. sempervirens*, Bigel.). Fig. 3505. Sts. very slender, scarcely woody but usually persisting over winter, creeping, bearing many weak reflexed small bristles: lfts. usually 3, thick, shining above, wedge-obovate or oval-obovate, usually obtuse, doubly serrate: fls. small, white, on few-flid., herbaceous nearly or quite leafless peduncles arising from the creeping canes: fr. small and of few drupelets, red to red-black, sour. Swamps or low sandy soils, Nova Scotia to Ga. and Kans.—Of no value for fr., but sometimes offered by dealers for covering the ground in moist places. The lvs. usually persist through the winter, and in sunny places they assume a fine bronzy hue.

3503. *Rubus invisus*, the cultivated form known as Bartel dewberry. (No. 61.)

BBB. *The southern dewberry or running blackberry.*

63. *trivialis*, Michx. SOUTHERN DEWBERRY. A variable and perplexing species, the difficulties being increased by the fact that the same plant may bear 3 kinds of lvs.: the large, broad blackberry-like lvs. on the young verdurous sterile shoots; the smaller lvs. on the canes that are to bear fr. and which often persist over winter and remain at flowering-time; the small lvs. that appear with or somewhat before the fls. It is seldom that the lvs. of sterile and flowering shoots of the same plant are preserved in herbaria. Canes very long, usually wholly prostrate (sometimes 10–15 ft.), thickly armed with prickles and sometimes bearing reddish bristles: lfts. usually 3, narrow-ovate to oblong, short-pointed, rather shallowly and sometimes bluntly toothed, the petiole and midribs usually prickly: fls. of medium size, mostly on simple, more or less prickly

peduncles: fr. usually oblong, sometimes excellent but oftener dry and seedy. From Va. to Fla. and Texas, and in cult. in two or three forms for its fr.—This is the common wild dewberry or running blackberry of the southern states, often a serious pest in old fields, ranging as far north as Va. and west to Okla. What are apparently forms of this species have been intro. for cult. for the fr. in the southern states.

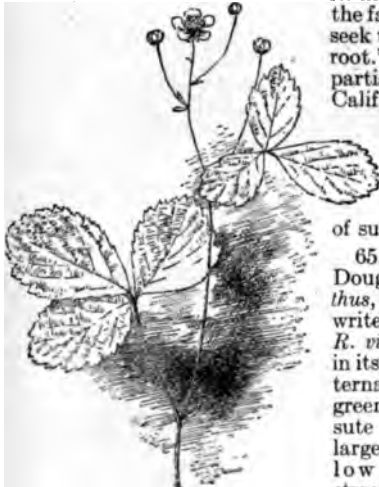
BBBB. *The western dewberries, with mostly pubescent lvs., and fls. often imperfect: species variable.*

64. *vitifolius*, Cham. & Schlecht. (*R. ursinus*, Cham. & Schlecht. *R. ursinus* var. *vitifolius*, Focke). CALIFORNIA DEWBERRY. Widely trailing evergreen, some of the sts. perhaps erect, with slender prickles: lfts. 3 or 5, about 2 in. long, ovate, doubly serrate, some of the upper ones simple or lobed, those on the vigorous shoots usually 3-foliate: fls. white, the petals of staminate fls. about $\frac{1}{2}$ in. long and of the pistillate $\frac{1}{2}$ in. or less: fr. black, mostly oblong, sweet, the drupelets pubescent. Calif., along streams and moist places.—A perplexing species, by some separated into two: *R. vitifolius*, with lvs. sparingly pubescent on both surfaces and glabrate with age, the st. only slightly hairy, fr. distinctly longer than broad, lvs. on vigorous shoots often unifoliate; and *R. ursinus*, Cham. & Schlecht., with st. and lvs. densely pubescent beneath and fr. only slightly elongate. Certain horticultural dewberries appear to be of this species, but they are of minor importance. The loganberry (which see, p. 1900) is said to be a hybrid between this species and probably *R. idaeus*, but the botanical origin of it is by no means clear. The Phenomenal is said also to have sprung from *R. vitifolius* through hybridization (p. 1900). The Mammoth blackberry of California is said to be a cross between *R. vitifolius* and the wild blackberry of Texas (*R. argutus*?). See Pacific Rural Press, Sept. 4, 1897, for description and portrait. The account says that the Mammoth "produces berries of immense size, supposed to be the largest

3504. Leaf of *Rubus invisus*, from strong shoot, showing the simple dentation ($\times \frac{1}{2}$). No. 61.

blackberry ever grown, berries $2\frac{3}{4}$ in. in length being frequently found. . . . The canes of the Mammoth are very peculiar, being very large and thickly covered with small, short spines. The canes start early in March, grow thick and stout until about 5 ft. high; they then take on a running habit and grow from 25-30

ft. in a season. Late in the fall the tips or stolons seek the ground and take root." The Mammoth is partially evergreen in Calif. The fr. is said to be more acid than the old Lawton blackberry, but "when perfectly ripe is sweet and of superior flavor."



3505. Swamp dewberry.—*Rubus hispidus* ($\times \frac{1}{2}$). No. 62.

65. *macropetalus*, Douglas (*R. myriacanthus*, Douglas). By many writers combined with *R. vitifolius*, but differs in its glabrous fr., always ternate lvs. which are green and sparingly hirsute on both sides, and larger fls.: it grows in low woods and on stream-banks from N. Calif. to Idaho and Brit. Col.: sts. trailing or

scandent, slightly hairy or glabrate, with weak prickles, and prickles on the petioles and midveins: terminal lft. broad-ovate, subcordate, doubly serrate, often somewhat lobed, acute or acuminate; lateral lfts. ovate: infl. slightly glandular, weak-prickly; fls. white; petals of staminate fls. about $\frac{1}{2}$ in. long and those of the pistillate somewhat shorter: fr. half-globular or slightly elongate, black, sweet, about $\frac{1}{2}$ in. long.

BBBBB. The exotic dewberry, with long prickly glaucous canes and large very sharp-toothed lfts.

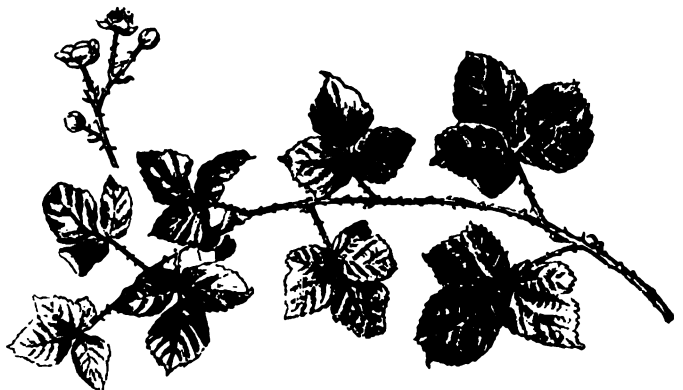
66. *dumetorum*, Weihe. Fig. 3506. Canes long and slender, terete, often 10-25 ft. long, trailing or half-prostrate, glaucous, thickly beset with rather small somewhat curved spines: lfts. usually 3, mostly broad-ovate pointed to acuminate, irregularly sharp-toothed, becoming bronzy and brown in autumn: fls. small, white, the calyx white-tomentose, on short pedicels in a cluster terminating leafy growths of the season: fr. of a few large black drupelets. Eu.—Intro. for the covering of banks and stony places, for which it is highly recommended. Its autumn color is attractive. Hardy in New England. L. H. B.

RUDBECKIA (after the two Professors Rudbeck, father and son). *Compositae*. CONE-FLOWER. Very attractive summer-blooming perennials or biennials, usually with yellow flowers.

Leaves usually alternate, the blades undivided or in some species much cut, as in the common Golden Glow: fls. both tubular and ray-like, the former usually purplish, the latter always yellow; involucre hemispheric, its bracts imbricated in 2-4 series; receptacle conic or very rarely convex, with chaffy concave scales subtending the disk-fls.; disk-fls. perfect, fertile, their corollas 5-lobed: achenes 4-angled, obtuse or truncate at the apex; pappus none or of 2-4 short teeth.—There are about 31 species, not counting Echinacea, all of N. Amer. Of these scarcely a dozen are of horticultural importance. Under Rudbeckia are often included in nursery

catalogues certain plants here referred to Echinacea and Lepachys. These three genera form an interesting floricultural group. Rudbeckia and Lepachys are typically yellow-fl. genera, while Echinacea is predominately rose-purple-fl. The chaff of the receptacle is usually persistent in Rudbeckia and deciduous in Lepachys. Among the hardy herbaceous species, there are several with striking habit and distinct foliage. There is a wide range of color in the rays of wild plants and many new races are yet to be perpetuated. Some of these with variations in the shape, color, length, color of disk-fls., and so on may serve as the basis of many fine forms. The season of bloom could doubtless be extended. The only full double form, apparently, is the Golden Glow, one of the best perennials of recent intro. Its origin is uncertain, but it appears to be a form of *R. laciniata*. About 1894 John Lewis Childs found it among some plants sent by correspondents. See Gng. 6:370. For structure of the Rudbeckia inflorescence or head, see Vol. III, Fig. 1535.

The cone-flowers are of easy cultivation in almost any soil and situation, from a semi-shady position to one in full sun. Most of the species are found inhabiting moist locations, but thrive well in the garden under the ordinary methods of cultivation, although *R. laciniata* and its double form, Golden Glow, do much better if abundantly supplied with moisture. *R. hirta*, the black-eyed Susan,—sometimes called by the children out West "nigger-heads,"—will thrive in the driest hottest situation, where many others would fail. The best known as a garden plant, and probably the showiest, is Golden Glow. If cut back severely when through blooming and well watered, it often produces a second crop of flowers. Autumn Glory will be well liked when better known. It is fine for massing and has a much longer blooming period than Golden Glow, commencing earlier and continuing until frost. It resembles *R. nitida*, an improved form of which, known as Autumn Sun, with bright primrose-yellow flowers, is a splendid acquisition. It grows 5 to 6 feet high, blooming from August to October. *R. triloba* is one of the very best, and, while a biennial, perpetuates itself through self-sown plants. It forms a dense twiggy bush somewhat over 3 feet high and nearly as broad if kept moderately well watered, and much smaller if in a dry situation. These plants may be used with effect as a border to a large bed of hybrid delphiniums, as the latter will tower above them and bloom in their young state. By the time the delphiniums are cut down for their second flowering, the rudbeckias hide their untidiness and are in their prime. The flowers are somewhat like those of the ordinary field black-eyed Susan, but smaller, and much more numerous. While doing best in full sun, they also do remark-



3506. *Rubus dumetorum*, an Old-World dewberry ($\times \frac{1}{2}$). No. 66.

ably well in semi-shade, as under overhanging shrubs or in shady corners such as the north side of a house would afford. They like a good open soil. When grown in the open with one stake to the center or main stem, and a string run loosely around the whole plant—being, in fact, a string hoop—catching the larger outer branches to



3507. *Rudbeckia triloba*. ($\times \frac{1}{4}$)

prevent breakage by the wind at the connection with the main stem, they make a very handsome compact plant. If well soaked at the roots, they may be taken up when in full bloom, and potted in a 10-inch pot, placed in a dark sheltered place over night, and then used for decorative purposes. They remain in good form for a month in a room or on the porch if not in a draft. They may also be taken up carefully and all the soil washed from the roots, and the roots placed in a large vase filled with water, where they present a bouquet arranged as Nature intended. An effective fall-flowering group may be formed by using the lighter-colored flower forms of *Hibiscus syriacus*—such as *Totus albus*, *Lady Stanley*, and *elegantissima*—for a center or background, and interspersing groups of the taller rudbeckias (except *Golden Glow*, which is too tall and spreading) and *boltonias* next to them. In front of these place *R. speciosa* and *R. triloba*, with the blue form of *Aconitum Napellus*, and for a border use *R. bicolor* var. *superba*, placed well to the front to be pulled up when its bloom is past. This group will give color from July until frost. The allied *Echinacea purpurea* and *E. angustifolia* are well adapted for grouping in open bays in shrubby borders, as their flowers are extremely durable and seem in harmony with such surroundings. Rudbeckias are easily increased by seeds, cuttings, or division. (W. C. Egan.)

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A. Base of upper lvs. cordate-clasping.

1. *amplexicaulis*, Vahl. Annual, 1-2 ft. high: rays $\frac{1}{2}$ in. long or more, yellow, often with a brown-purple base; disk brownish, finally somewhat cylindrical. Low grounds, La. and Texas. B.B. 3:418.

AA. Base of upper lvs. not cordate-clasping.

B. Color of disk brown or dark purple: shape of disk never cylindrical.

C. Lower lvs. deeply 3-cut.

D. Duration biennial: disk black-purple.

2. *triloba*, Linn. Fig. 3507. Biennial, 2-5 ft. high, bright green: lvs. thin, usually toothed, the lower ones 3-lobed: rays 8-10, deep yellow, base sometimes orange or brown-purple: chaff awned. Moist soil, N. J. to

Mich. S. Ga. to La. and Mo. B.B. 3:415. B.R. 525. G.W. 1, p. 187.—Blossoms the first year from seed.

DD. Duration perennial: disk dull brownish.

3. *subtomentosa*, Pursh. Perennial, 2-5 ft. high, ashy gray and densely hairy: lvs. thick: rays 15-20, yellow, sometimes with a darker base: chaff blunt. Prairies, Ill. to Texas. B.B. 3:415.

CC. Lower lvs. not deeply 3-cut.

D. Plants bristly hairy.

E. Rays $\frac{1}{2}$ - $\frac{3}{4}$ in. long.

4. *bicolor*, Nutt. Annual, 1-2 ft. high: lvs. 1-2 in. long: rays yellow, with a blackish purple base or all yellow. Pine woods or sandy soil, Ark., Texas, and east to Ga. Var. *superba*, Hort. Haage & Schmidt, has heads 2 in. across: rays yellow above, purplish brown below. Gt. 47, p. 220. S.H. 2, p. 169. J.H. III. 63:247.

EE. Rays 1-2 in. long.

5. *hirta*, Linn. BLACK-EYED SUSAN. YELLOW DAISY. Biennial or annual, 1-3 ft. high, simple or branched, hispid: lvs. 2-5 in. long: rays golden yellow, sometimes orange at base. Dry and open ground; common over wide range and often rather a troublesome weed. B.B. 3:416. Gn. 49:154.—*R. conspicua*, Hort., is probably only a garden form with long narrow orange-yellow ray-florets and a black disk. Var. *vomerensis*, Hort., differs from the type in having larger fl.-heads with broad ray-fls. which are light canary to golden yellow.

DD. Plants nearly glabrous.

E. Lvs. mostly entire.

6. *fulgida*, Ait. Perennial, 1-2 ft. high: lvs. more or less hairy on both sides, the lower ones 3-nerved: rays 12-14, 1 in. long. Dry soil, Pa. to Mo., south to La. and Texas. B.M. 1996. Mn. 6:221. Var. *compacta*,



3508. *Rudbeckia laciniata*. (\times nearly $\frac{1}{2}$)

Hort., is a dwarf compact-growing form. Var. *variabilis*, Hort., is a form growing about 3 ft. high, with numerous rigid sts.: fls.-heads with yellow and brown ray-florets and dark purple disk-florets.

EE. *Lvs. irregularly serrate.*

7. *speciosa*, Wenderoth. Perennial, 1-3 ft. high: rays 12-20, becoming 1½ in. long. Moist soil, Pa. to Mich., Ark., and Ala. G.C. II. 16:373 (heads 3-4 in. across, rays more than 30, in 2 series). Gn.W. 24:207.



3509. *Rudbeckia laciniata*, Golden Glow. (×¼)

G. 3:427 (as *R. Newmanii*).—*R. Newmanii*, Loud., is generally considered a synonym of this species.

BB. *Color of disk greenish or yellowish.*

c. *Lvs. entire or barely dentate.*

D. *Height 2-4 ft.: lvs. bright green.*

8. *nitida*, Nutt. This and the next are southern perennials, with lvs. entire or barely dentate: rays drooping, pure yellow, several or numerous; disk finally columnar, 1-2 in. long. Wet ground, Ga. to Fla. and Texas. Gn. 47:201.

DD. *Height 4-9 ft.: lvs. glaucous.*

9. *maxima*, Nutt. Closely allied to *R. nitida* and differing as indicated in the key. Moist pine woods and plains, Ark., La., Texas. Gn. 47:418. G. 30:281.

cc. *Lvs. (upper st.-lvs.) 3-cleft.*

10. *laciniata*, Linn. (*R. ampla*, A. Nels.). Fig. 3508. Perennial, 2-7 ft. high: lower st.-lvs. 3-5-parted, upper ones 3-cleft: rays yellow, few or several, soon drooping; disk cylindric in fr. Moist ground, Canada to Fla., west to Mont. and New Mex. G.F. 2:281 (adapted in Fig. 3508). Golden Glow is a full double form, 2½-3½ in. across. Fig. 3509. Gng. 5:5, 117; 6:370. A.F. 12:274, 275. Gn. 50, p. 411; 62, p. 305. G.C. III. 20:339.

ccc. *Lvs., especially the lower ones, sometimes 2-cleft, very rarely entire.*

11. *californica*, Gray. A pubescent, rather rough, simple-stemmed perennial, with the dentate lvs. usually 2-lobed at the base: heads solitary, long-peduncled, composed of numerous rays which frequently exceed 2 in. diam., making a showy fl. nearly 5 in. wide. Pacific coast. J.H. III. 42:281.—One of the best moderate-sized rudbeckias.

R. angustifolia, Linn., is *Echinacea angustifolia*.—*R. Drummondii*, Paxt. (*Obeliscaria Drummondii*, Maund.). Perennial, herbaceous: sts. slender: lvs. pinnate, the lobes linear-lanceolate, slightly jagged, acute: rays large, oblong, obtuse, reflexed, bright orange, deeply stained with dark brown at their base. N. Amer. (?)—Botanically unknown, probably some species of *Lepachys*. P.M. 6:51. B. 5:201.—*R. pinnata*, Vent., is *Lepachys pinnata*.—*R. purpurea*, Linn., is *Echinacea purpurea*.

WILHELM MILLER.

N. TAYLOR.

RUDGEA (named in honor of Edward Rudge, an English botanist). *Rubiaceae*. Shrubs or small trees, glabrous or pubescent, suitable for the warmhouse and perhaps hardy in the extreme southern U. S.: lvs. opposite, subsessile or petioled, leathery: fls. medium to rather large, paniculate, sessile or pedicelled, rarely capitate; calyx-tube ovoid or obconical, limb short, 5-rarely 4-cleft or -parted, persistent; corolla smooth or villous, limb 5-rarely 4-lobed, erect or spreading; stamens 5, rarely 4; disk various; ovary 2-celled: fr. small, dry or succulent, with 2 nutlets which are dorsally plano-convex and smooth or sulcate and longitudinally sulcate on their ventral face.—About 115 species, Trop. Amer. *R. leucocéphala*, Schumann (*R. macrophylla*, Benth. *Psychotria leucocéphala*, Brongn.). Lvs. large, subsessile, obovate-oblong: fls. cream-colored, sessile, in fascicles densely clustered in globose heads; corolla-segms. obtuse; peduncles short. Brazil. B.M. 5653. F.S. 17:1720, 1721. G.C. II. 12:81. H.U. 6, p. 257. J.F. 3:292, 293.

F. TRACY HUBBARD.

RUE: *Ruta graveolens*. *R. Anemone*: *Synedra*. *R.*, *Goat's: Galega officinalis*.

RUELLIA (after Jean de la Ruelle, a French botanist). Syn. *Stephanophyllum*. *Acanthaceae*. Villous, pubescent or rarely glabrous herbs or shrubs, a few species grown under glass and also outdoors mainly in the South.

Leaves opposite, entire or rarely dentate: fls. shades of blue or purple to violet, white, rose to red and rarely yellow to orange, sessile to long-peduncled, axillary, solitary or fascicled or cymose paniculate; calyx deeply 5-cleft or 5-parted, segms. linear or lanceolate; corolla-tube straight incurved or abruptly inflexed, the limb spreading, the lobes ovate or rounded; stamens 4, didynamous: caps. oblong-linear or clavate.—About 200 species, chiefly Trop. S. Amer., a few in N. Amer. and extra-Trop. S. Amer., some in Trop. and S. Afr., Temp. Asia and in Austral.

A. *Blossoms sessile or nearly so.*

B. *Lvs. green.*

C. *Fls. blue, 1½-2 in. long.*

ciliösa, Pursh. A hardy perennial herb, about 1½ ft. high, erect or prostrate, hirsute or pubescent: lvs. hairy, ciliate, usually oblong, sessile or short-petioled, 1½-3 in. long: fls. solitary or clustered, axillary, blue, 1½-2 in. long. Aug., Sept. In dry, light soil, N. J., south and west. B.B. 3:203.—Prop. by seeds or division.

Harveyana, Stapf. Perennial: sts. rather slender, trailing or ascending, 4-angled above: lvs. petioled, green, oblong or elliptic-oblong: fls. produced one at a time in the upper axils, sessile, pale lilac with a white throat and tube; sepals very unequal, 4 linear-subulate, the fifth wide-lanceolate; corolla-lobes elliptic-rounded; ovary glabrous: caps. oblong-lanceolate, not stipitate. Mex. B.M. 8485.

cc. *Fls. rosy, 2-6 in. long.*

macrantha, Mart. It forms a compact, many-stemmed shrub, 1-6 ft. high, with ovate-lanceolate lvs. 4-6 in. long; fls. large, bell-shaped, with tubular base, purplish rose with purple veins, solitary in lf-axils. Brazil. B.M. 7872. G.C. III. 17:45; 30:467; 43:27. R.H. 1881:410. Gn.W. 5:341; 10:21. Gt. 61, p. 534. G.W. 2, p. 297.—G. W. Oliver says in his "Plant Culture" that *R. macrantha* is of easy cult. and is one of the best greenhouse flowering plants for amateurs. Cuttings rooted in Sept. furnish fair-sized flowering plants in Jan. These, if desired, may be planted out in late spring, when they will have formed large specimens, which may be lifted and potted.

BB. *Lvs. marked with white.*

c. *Fls. white, often veined with lilac.*

Devosiana, Hort. A low-growing tender Brazilian species, with lanceolate lvs. marked on the upper surface with white along the nerves and having the lower

surface entirely purple; fls. rather small, usually white with blue stripe, axillary; corolla-tube suddenly dilated and bent at the middle. B.M. 8406.

cc. *Fls. carmine or rose.*

Makoyana, Hort. A compact bushy plant resembling *R. Devosiana*, Hort., in foliage, but differing in the color of the fls. (bright carmine) and by their somewhat larger size. Brazil. R.B. 21:109. R. H. 1896: 576.—Prefers shade. It is said that the color of the foliage is better when soot is mixed with the soil.

AA. *Blossoms on long peduncles.*

B. *Fls. blue or purple.*



3510. *Ruellia formosa*. ($\times \frac{1}{2}$)

tuberösa, Linn. A perennial herb, 2-3 ft. high, with oval or ovate lvs. 2-3 in. long and blue fls. $1\frac{1}{2}$ -2 in. long, in terminal, nearly naked panicles; stigmas single; caps. 12-16-seeded. S. W. U. S.; cult. in Fla.

Lorentziana, Griseb. Glandular herb, little branched, the sts. quadrangular; lvs. decussate-opposite, channeled below, oval, subcordate or attenuate at base, acuminate; infl. terminal in a lax leafy panicle; fls. long-peduncled, usually in 3's, bluish purple; sepals free, linear; corolla funnel-form, 5-lobed, rounded, the inferior emarginate; ovary oblong; caps. cylindrical-conical. Uruguay. R.H. 1902:136.

BB. *Fls. red.*

c. *Peduncles much branched.*

amöna, Nees (*Stephanophyllum longifolium*, Pohl). A half-hardy perennial, about $1\frac{1}{2}$ ft. high; lvs. oblong-lanceolate or oblong, narrowed at both ends; margins repand-denticulate or simply repand; fls. bright red, in axillary sprays in summer. Brazil. F.M. 1880:419.

cc. *Peduncles but little branched.*

formösa, Andr. Fig. 3510. A low-growing, tender, herbaceous perennial: lvs. ovate, rounded at the base, hairy on both sides; fls. on straight, axillary peduncles; corolla scarlet, showy, $1\frac{1}{2}$ in. long, the upper 2 lobes joined for half their length. Summer. Brazil. B.M. 1400.—Cult. in Calif.

R. solitaria, Vell., is offered in the European trade, but its identity is doubtful, as *R. solitaria*, Vell., has been referred by some to *R. Schnaeriana*, Lindau, by others to *R. calvescens*, Lindau.—*R. virians*, Vent., is *Dædalacanthus nervosus*.

F. W. BARCLAY.

F. TRACY HUBBARD.†

RULINGIA (after J. Ph. Ruling, a botanist of Göttingen). *Sterculiaceæ*. Shrubs or subshrubs with stellate tomentum or hairs, useful as greenhouse plants and for the rockery in warm climates, as the southern United States.

Leaves entire, toothed or lobed; stipules narrow and deciduous; fls. mostly white, small, in lf.-opposed or terminal, rarely axillary cymes; calyx 5-lobed; petals 5, broad and concave or convolute at base, with a small, broad, or linear ligula at the top; stamens 5 without anthers, linear-lanceolate and alternate with the petals, 5 perfect and opposite the petals; ovary sessile, 5-celled; fr. tomentose or beset with prickles or soft setae, loculicidally valvate.—About 20 species, all Australian except one from Madagascar.

A. *Lvs. 1-3 in. long.*

pannösa, R. Br. Eventually a shrub, several feet high, but flowering freely at a young age; lvs. scabrous-pubescent above, densely 'velvety' hirsute below, on older plants ovate-lanceolate to lanceolate, on young plants broader and often 3-4-lobed; cymes shortly pedunculate; fls. white. B. M. 2191.—The plant offered in Calif. as *Pomaderris apetala* is said to belong here. Prized by some for the fleecy coating of its lvs.

AA. *Lvs. usually less than 1 in. long.*

parviflora, Endl. A low shrub, with branches $\frac{1}{2}$ - $1\frac{1}{2}$ ft. long, ascending or prostrate; lvs. ovate or ovate-lanceolate, obtuse, deeply crenate, mostly lobed; fls. pinkish, in shortly pedunculate cymes.—Cult. in Calif., where it is spoken of in high terms as a rock-plant on account of its trailing habit and myriads of small pink fls. borne in spring.

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RUMEX (the Latin name, of unknown origin). *Polygonaceæ*. Dock. Sorrel. Herbs, mostly perennial with strong roots, usually weedy, but some of them afford leaves for "greens," and others are useful for bold effects.

Rumex is closely allied to *Fagopyrum*, the buckwheats, *Rheum*, the rhubarbs, and *Polygonum*, the jointweeds. The rumexes are mostly leafy-stemmed plants, with small fls. in panicles, the pedicels usually in whorls and jointed; fls. perfect or imperfect, with 6-parted calyx (no petals), the 3 inner lobes larger and generally one or all of them bearing a grain or tubercle near the center; these more or less enlarged inner calyx-lobes or sepals are called "valves" in fr.; stamens 6; stigmas 3; fr. a 3-sided often margined or winged achene.—Species probably considerably more than 100, in many parts of the world, some of them on dry land and some in swamps; a few species are widespread weeds in temperate climates, being among the commonest of intro. plants about old buildings and in waste places. They have little horticultural value. Prop. readily by seeds. In the larger species the sts. are grooved and hollow. Most of them are erect-growing plants. See *Dock* and *Sorrel*.

A. *Docks: lvs. not hastate; fls. perfect, or at least not truly dioecious (sometimes polygamo-dioecious).*

B. *Wings of calyx bearing one or more tubercles.*

Patiëntia, Linn. HERB PATIENCE. SPINAGE DOCK. Tall strong erect nearly simple perennial, reaching 5 ft.

when in fl., glabrous: root-lvs. (Fig. 1336, Vol. II) elliptic-ovate, tapering both ways, the margins undulate, the blade 8–12 in. long; st.-lvs. ovate-lanceolate, long-acuminate, more or less rounded at the base: infl. long and compound (often 2 ft. long), dense in fr.: wings cordate, about $\frac{1}{4}$ in. across, veiny, entire, one of them bearing a small tubercle near the base. Eu., but naturalized in many places.—An excellent plant for greens, the strong root-lvs. being used in early spring.

crispus, Linn. **CURLY DOCK. YELLOW DOCK.** Tall, often 3–3½ ft.: lvs. long-lanceolate, wavy-margined, rounded at the base: valves entire, the tubercles usually 3, the infl. not leafy. Naturalized from Eu., and now one of the common docks about yards and in old fields.—Not cult., but the lvs. sometimes used for greens.

obtusifolius, Linn. **BITTER DOCK.** A common weed: lvs. much broader, very obtuse or even cordate at base, obtuse at apex, not wavy-margined: valves long-toothed, the tubercle usually 1, the infl. somewhat leafy below. Eu.

BB. *Wings of calyx not tubercle-bearing.*

venosus, Pursh. Perennial, 1½ ft. or less tall, glabrous, branched: lvs. oblong-ovate or ovate-lanceolate, usually tapering at both ends, entire, the stipular sheaths (ochreae) funnelform and prominent: valves of fr. large and thin, entire, 1 in. or more across, red-veined and showy, the pedicels hanging in fr. Mo., north and west.—Once offered as an ornamental plant because of the very showy wide-winged fruiting calices.

hymenosépalus, Torr. **CANAIGRE. RAIZ COLORADA.** Erect, reaching 3 ft., glabrous, the root of clustered fusiform tubers: lvs. oblong-lanceolate, sometimes 1 ft. long, narrow at either end, short-petioled, entire, gray-green, somewhat mottled beneath: fls. perfect, large, in crowded panicles, green: fruiting calyx-lobes $\frac{3}{4}$ in. across, brown, entire, veiny, the pedicels drooping. Okla. and Texas to Calif. B.M. 7433.—The plant has some ornamental value, but is of economic importance as a tannin-producing plant, although the supply is insufficient to maintain an industry. The tannin is secured from the dahlia-like roots. For literature on the economic uses of the plant, consult reports of experiment stations in Ariz., Calif., and elsewhere, and Wootton & Standley, *Flora of New Mexico* (Smithsonian Institution).

occidentális, Wats. Stout perennial, reaching 3 ft., glabrous: lvs. lanceolate to ovate-lanceolate, more or less wavy-margined, obtuse or nearly so, the base subcordate, long-stalked: valves of the fr. subtriangular, somewhat toothed, veiny, brown, $\frac{1}{2}$ in. across. Labrador to Alaska, descending along the Rocky Mts. and reaching Texas and New Mex.—Once intro. as an ornamental subject, because of its profuse and somewhat showy fruiting calices.

Hydrolápathum, Huds. **GREAT WATER-DOCK** of Great Britain and elsewhere in Eu., a stout perennial 4–6 ft. high, with very large lvs., sometimes planted for bold effects along water-courses: lvs. broadly oblong-lanceolate to lanceolate, sometimes 2 ft. long, tapering below but the base often somewhat rounded, acute at apex, the margins crenulate: panicle very large, with rather crowded mostly leafless whorls, the fruiting pedicels jointed near the base and equaling or exceeding the sepals: valves broad, nearly entire, all tubercle-bearing.

AA. *Sorrels: lvs. mostly (at least the radical ones) hastate or sagittate: fls. imperfect, the plants sometimes dioecious.*

B. *Plant annual.*

roseus, Linn. One to 2 ft., with spreading and branched sts., glabrous and somewhat glaucous: lvs. small, deltoid-ovate, entire, short-pointed, truncate-cuneate or almost cordate at base: racemes short and

leafless or nearly so, the pedicels drooping in fr.: valves cordate-orbicular, $\frac{1}{4}$ – $\frac{1}{2}$ in. across, thin, rosy-veined, without callosities. Egypt to Persia.—Rarely cult. as an ornamental for its showy fruiting calices.

BB. *Plant perennial (R. Acetosella sometimes annual).*

Acetòsa, Linn. **GARDEN SORREL.** St. strong and erect (3 ft. or more tall in fr.), furrowed, the plant glabrous: root-lvs. thin and light green, oblong and obtuse, with sharp auricles at the base (Fig. 1337, Vol. II), the petioles slender; st.-lvs. relatively narrow, acuminate: infl. large and ample, the larger part of the fls. sterile (plant sometimes dioecious): valves entire or very nearly so, not over $\frac{1}{4}$ in. across, cordate-ovate, each with a callosity near the base, the outer small scales reflexed. Eu. and Asia, and naturalized in some places in this country.—Useful for early spring greens, but later in foliage than *R. Patientia*.

Acetosélla, Linn. **COMMON FIELD or SHEEP SORREL.** Common in all old fields, where it is taken to indicate sterile or at least unproductive soil: lvs. oblong, from a hastate-lobed base: fls. reddish, in erect racemes. Eu.—Not cult., but the sour root-lvs. are sometimes used for greens.

scutátus, Linn. **FRENCH SORREL.** Lower, with many branching prostrate or ascending sts., glaucous: lvs. somewhat fleshy, the radical ones long-stalked and cordate-ovate-obtuse, the st.-lvs. short-stalked and hastate-fiddleform and acute or sometimes 3-lobed: valves thin, cordate, without callosities. Eu., Asia.—Grown in several varieties in Eu., and sometimes cult. in this country for greens. It is a summer sorrel. L. H. B.

RÚNGIA (named for F. F. Runge). *Acantháceæ*. Creeping, diffuse or erect herbs, glabrous or villous; warmhouse plants: lvs. entire: spikes cone-like; bracts in 4 ranks (whereof 2 alternate are sterile), much larger than the calyx, broad with prominently scarious margins; calyx 5-parted, segms. acuminate; corolla-tube short, straight, limb 2-lipped, posterior lip entire or 2-toothed, anterior often longer, spreading and 3-cleft; staminodia none; disk annular or short-cup-shaped: caps. ovoid or oblong.—About 30 species in the warmer parts of the Old World. *R. eriostáchyra*, Hua. St. pubescent: lvs. ovate-lanceolate, 2–3 in. long: fls. white and yellow in crowded spikes; the bracts and calices covered with long white hairs. Trop. Afr.

RUPÍCOLA (Greek *rock* and *grower*, presumably referring to its place of growth). *Epacridáceæ*. Shrub: lvs. small, short-petioled: fls. solitary in the lf.-axils, borne on bracteate pedicels which are shorter than the fls.; calyx-lobes 5; corolla 5-cleft, with a very short tube and with spreading divisions which cover themselves in the bud in the form of a quincunx; ovary 5-celled, with numerous seeds.—One species, New S. Wales. The genus is closely allied to *Epacris*. *R. sprengelioides*, Maiden. Shrub 2½ ft. high with twiggy branches: lvs. linear-lanceolate $\frac{3}{4}$ –1 in. long, rigid: fls. solitary, axillary, forming a raceme-like leafy infl. with a barren apex; corolla subrotate, almost $\frac{1}{2}$ in. across, milky white; segms. ovate. B.M. 8438.

RÚSCUS (an old Latin name). *Liliáceæ*. **BUTCHER'S BROOM.** Erect shrubs with branched partially woody stems, hardy in southern Europe and the southernmost United States.

Leaves minute, bract-like, on lf.-like branches (cladodia) which are alternate, leathery, persistent, and sessile: fls. small, fascicled in the middle of the upper, rarely lower surface of the cladodia, dioecious: berry globose, pulpy, and indehiscent.—Three to 5 species, Eu., Madeira, and Caucasus. The foliage of this plant (Fig. 3511) is composed of lf.-like branches or cladophylls, as in the florists' smilax. Dried, bleached, and

colored sprays (mostly dyed red) are now much used in florists' decorations.

aculeatus, Linn. Shrub, $1\frac{1}{2}$ – $3\frac{1}{2}$ ft. high: phyllodia ovate-lanceolate, $\frac{1}{2}$ – $1\frac{1}{2}$ in. long, tapering into a spiny point: fls. 1–2, short-pedicelled: berry red, $\frac{1}{2}$ in. thick. Spring. Gn. 34, p. 231. R.H. 1984, p. 545.—Cult. in Fla. and S. Calif.

R. androgynus, Linn.—Semele androgyna, Kunth.—*R. Hypoglôsum*, Linn., has been highly commended in Germany as a decorative subject. This species and *R. Hypophyllum*, Linn., are both natives of S. Eu., where they have been studied by several botanists, some of whom distinguish them by various characters, while others unite them into a single species. J. G. Baker considers *R. Hypoglôsum* a variety of *R. Hypophyllum*, differing in having the costa under the cluster of fls. in the form of a large leafy bract lacking entirely the texture of the phyllodium. In B.M. 2049, *R. Hypophyllum* is shown with minute white fls. and handsome red berries nearly $\frac{1}{2}$ in. thick.—*R. racemôsus*, Linn.—*Danaë racemosa*, Moench.

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3511. *Ruscus aculeatus*.

Leaves opposite or verticillate, usually small, reduced to scales on the branches: fls. in bracteate dichotomous cymes, either laxly or densely many-fld., sometimes reduced to a single fl., red; calyx deeply 5-cleft or 5-parted, segms. strongly imbricate; corolla-tube cylindrical, limb somewhat 2-lipped, 5-cleft, the lobes all rounded; stamens 4, didynamous: caps. subglobose, septicidally dehiscent, valves 2-cleft.—About 20 species, Mex. and Cent. Amer. A synopsis of *Russelia* by B. L. Robinson, with a key to the species, will be found in Proc. Amer. Acad. Arts. & Sci., vol. 35, No. 16, March, 1900.

Russelias are of easy cultivation. *R. juncea* and its varieties make excellent basket-plants, being almost continuously in bloom. Propagated by cuttings.

A. Peduncles 1–3-fld.

juncea, Zucc. (*R. scoparia*, Hort.). CORAL PLANT. Fig. 3512. A tender shrubby plant, with smooth, somewhat rush-like branches, nodding or pendulous at the top: lvs. linear-lanceolate or ovate, small, becoming minute bracts on the branches: raceme very loose, remotely fld.: peduncles elongated. B.R. 1773. P.M. 4:79. G.W. 5, p. 379. Var. *semperflorens*, Hort., has been mentioned. Gt. 1:5.

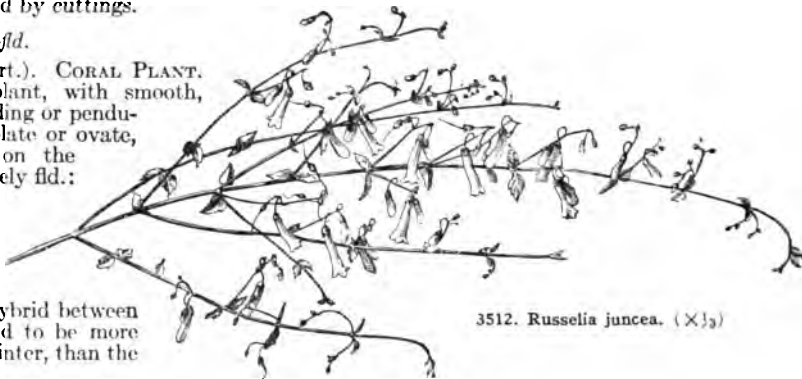
Lemoinei, Hort. (*R. juncea* var. *Lemoinei*, Hort.), is a garden hybrid between *R. juncea* and *R. sarmentosa*, said to be more floriferous, especially during the winter, than the parents.

elegantissima, Hort. (*R. juncea* var. *elegantissima*, Hort.), is another product of the same cross as the above and said to have similar characters.

AA. Peduncles many-fld.

sarmentosa, Jacq. (*R. multiflora*, Sims). A tender shrub, becoming 4–6 ft. high: lvs. opposite, ovate, acuminate, serrately crenate: fls. verticillate, many in a terminal raceme, bright red, erect or drooping, about $\frac{1}{2}$ in. long. B.M. 1528. P.M. 16:163. R.H. 1852:281. R.B. 25:61.

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3512. *Russelia juncea*. ($\times \frac{1}{3}$)

RUSTS. The plant rusts are fungi constituting the large and well-defined order Uredinales, which contains approximately 3,000 species distributed in about forty genera. They are all obligatory parasites, mostly on angiosperms, few on gymnosperms, and a small number on ferns.

Relations between host and parasite.

The mycelium of the rust fungi (see *Fungi*) lives symbiotically within the tissues of the host. It is generally confined to the intercellular spaces, but short branches or haustoria penetrate the cells and absorb nutriment from them. Usually not more than one or two haustoria are found within a single cell and only a small proportion of the host cells are thus invaded, although the mycelium itself is abundant in the intercellular spaces.

The extent to which the mycelium spreads within the tissues of the host and its duration of life vary greatly with different species of rusts. In most of the species which inhabit annual parts of plants, as leaves and stems, the mycelium resulting from individual infections is localized within a more or less restricted area, as in case of hollyhock rust, carnation rust, and wheat rust, and generally persists as long as the infected parts remain alive. That plants thus infected nevertheless become completely covered with rust spots is attributable to the large number of separate infections which occur and not to the spreading of the mycelium through the whole plant. When biennial or perennial parts are locally infected, the mycelium often persists for two years, as in the rust of the red cedar, *Gymnosporangium globosum* and *G. juniperi-virginianæ*, or becomes perennial, as in the rust of juniper, *Gymnosporangium clavariiforme*, and the blister rust on stems of pines, *Peridermium cerebrum*. Many rusts have mycelia which extend throughout the tissues of the host. This type of mycelial distribution is characteristic of the orange rust of the species of brambles, *Gymnoconia interstitialis*, and of a number of rusts infecting herbaceous perennial plants, as the rust of Canada thistle, *Puccinia suaveolens* and the pea rust (*Uromyces pisi*) on the cypress spurge (*Euphorbia Cyparissias*). In such cases the mycelium of the fungus remains dormant in the rhizomes or in the roots and in spring grows out into the developing shoots which are usually characterized by spindling growth

with long internodes and small and somewhat deformed leaves. Shoots which are normally trailing or prostrate become erect. This effect is sometimes observed in annual plants also, as in the case of *Euphorbia maculata* infected by *Uromyces euphorbiae*. Blackberry canes growing out from roots infected by *Gymnoconia*, besides having the characteristic growth described above, are free from thorns.

In spite of the intimate association of rust fungi with their hosts, very little apparent injury results to the

plants during the vegetative growth of the parasites. Deformations of various kinds are common in plants attacked by these fungi. Aside from those described above there is in many cases a marked stimulation to abnormal growth which results in the formation of galls, as the well-known cedar apples, or in enlarged and distorted flowers, fruits, and branches, or in the production of witches' brooms. The greater number of rusts, however, do not cause any abnormal deformation of their hosts, and the presence of the fungus is usually not evident until the time of spore-production, although it may be assumed, and is sometimes apparent, that the plants have been weakened or retarded in growth, particularly when the mycelium is widely dispersed in the tissue. At the time of spore-production, the injury to the host becomes unmistakable. The spores are produced in pustules beneath the epidermis. This is finally ruptured and the spores break forth forming the characteristic orange, brown, or black spots and patches to which these fungi owe their name. The injury is brought about both by the withdrawal of nutriment from the host cells and by the extensive destruction of the epidermis of the host and the resulting loss of water from the tissues beneath. The magnitude of the injury differs with the extent to which the plant is infected. Plants which are severely infected often lose their leaves, which wither and die prematurely. In annual or biennial plants this injury hastens the death of the plants, as in the hollyhock and the cereals, or, as in greenhouse carnations, impairs their vigor to such a degree that the plants are of little commercial value. In perennial plants like asparagus, the yearly injury of the assimilating parts results in the slow weakening of the roots through malnutrition and finally in the death of the plants. Apple trees are frequently defoliated as a result of infection by the cedar rust (*Gymnosporangium*). In plants grown for crops, whether flowers, fruits, or other parts are sought, these injuries diminish the yield, but in ornamentals the mere presence of the rust pustules over the surface greatly detracts from the appearance of the plants.

Specialization among rust fungi.

Rust fungi do not attack various plants indiscriminately. In general, each morphologically distinguishable species is confined to one or to a relatively small group of closely related host plants. Nevertheless, the degree of adaptation to particular hosts varies much with different species of fungi. Some species are truly plurivorous. A striking example of this habit is furnished by the hollyhock rust (*Puccinia malvacearum*) which inhabits about forty species belonging to many different genera of the subfamily Malvæ, and passes readily from one host to another. Many rusts which are apparently plurivorous have been found on closer investigation to be divisible into a number of so-called biological or physiological races, each of which is restricted to a comparatively small group of host plants. This type is illustrated by the common cereal rust (*Puccinia graminis*). This occurs on all the common cultivated cereals and on about 180 species of wild grasses. The forms on the different hosts are not morphologically distinguishable but culture experiments with this rust on the cereals and the common grasses have shown that it falls into a number of biologic races each of which is more or less restricted to a small group of host plants, and cannot readily be transferred to plants outside of that group. Thus the form on oat infects also orchard grass and a few other grasses, but not wheat, barley, or rye; the form on rye infects also barley and some other grasses, but not wheat; and the form on wheat infects less readily barley, oat, rye, and some other grasses. This type of specialization is very common and occurs in many species which have a wide range of host plants. The separation into physiological races is not always sharp and clear-cut and often

a transfer of a race from one host to another can be accomplished by so-called bridging species of host plants, i. e., species which act as a common host to two races of rust. It appears also that the degree of specialization of different forms is not the same in different geographical regions. It is readily seen that the matter of specialization of rusts is one of considerable economic significance. In the case of truly plurivorous species of rusts, many wild plants may be the source of infection for cultivated plants. Thus the hollyhock is easily infected from *Malva rotundifolia* and other wild mallows; but, in the case of species which, like the cereal rust, have become differentiated into a number of physiological races, there is comparatively little danger of infection from wild plants since the rust on each host has become more or less strictly adapted to its particular host. Thus, for example, different members of the pink family are inhabited by the carnation rust (*Uromyces caryophyllinus*) but each genus has its own physiological race which does not infect the members of other genera of the family. The specialization of rusts to particular hosts has also another economic bearing. When a given rust is restricted to one or more species of a genus but does not infect the others, these are said to be immune. Just as there are immune species, there may be immune varieties within a species, as the phrases "disease-resistant cowpeas," or "rust-resistant carnations," indicate. This fact, that the cultivated varieties of a given species show varying degrees of resistance, furnishes the basis for the breeding of immune varieties, which is one of the most promising means of overcoming the danger from attacks of rust.

Remedial measures.

Of the various groups of fungi, the rusts are the most difficult to combat. For most forms, especially those infecting cereals and other agricultural crops, no satisfactory methods of control have been developed since the usual methods of disease-prevention are either unprofitable or not applicable here. Even with horticultural crops, direct remedial measures have proved successful only in few cases, as with the apple rust, which can be successfully controlled by spraying with bordeaux mixture. Various mixtures, such as copper sulfate (one pound to fifteen gallons of water) and potassium sulfide (one ounce to one gallon), have been recommended and tried for carnation rust, but the growers are far from being in accord as to the effectiveness of these remedies. Environmental conditions have much to do with the prevalence of rust. Thus the severity of outbreaks of asparagus rust and probably of other rusts also is dependent on the amount of dew. In greenhouses it has also been found that the environment has much to do with the presence of rust on carnations and chrysanthemums, and that the maintenance of the best cultural conditions is one of the surest means of controlling rust on these plants. This method of control is, however, applicable in the field only in a restricted degree.

While the methods of direct control of rusts have not on the whole proved very successful, the indirect method by the breeding of resistant varieties seems to offer the most promising solution of the problem. Although the so-called rustproof varieties of plants have not generally proved to be entirely resistant, yet different degrees of resistance have long been noticed by growers, and varieties particularly susceptible to rust have been gradually eliminated. The history of the carnation rust in the United States probably furnishes an illustration of this process. Twenty years ago horticultural literature was replete with discussions of the carnation rust which caused much agitation among growers. At that time much was written of "rustproof" varieties, and mention is frequently made of varieties thrown out on account of rust. At the present time the rust once regarded as the "most dreaded of the carnation diseases" attracts but little attention, and within

the last few years has been scarcely mentioned in florists' journals. That a part of this result at least is due to the gradual elimination of susceptible varieties can scarcely be doubted, but the fact should not be overlooked that the seriousness of the early rust invasion may have been exaggerated, for even then conservative men felt impelled to warn against the agitated state of mind which caused growers to see rust in every discolored leaf. (McBride, *Am. Flo.* 8 p. 930, 1893; Herr, *ibid.* p. 980.)

Botanical features.

Botanically the rusts are of great interest because their life-cycle consists typically of two distinct generations. These are technically known as the gametophytic generation and the sporophytic generation, but for



3513. The cluster-cup stage of the wheat rust fungus growing on barberry leaf.



3514. Colonies of rust on the stem of wheat.

simplicity they may be designated respectively as the aecidial stage and the telial stage, terms derived from the names of the principal spore-producing structures which characterize the two phases. Each of these generations may produce one or more spore forms. The life-cycle of a rust is best understood by means of an example. One of the most familiar is the wheat rust.

If barberry bushes in the neighborhood of wheat-fields are examined in spring (May and June), there will usually be found on some of the leaves yellowish spots. Within the discolored area, on the under side of the leaf, there are a number of small cup-like openings with fringed margins. (Fig. 3513.) These are termed aecidia and from them yellow aecidiospores, which can be seen scattered like dust around the cups, are discharged. About the same time or a little earlier, flask-like pycnidia break through the epidermis on the upper side of the leaf. These discharge minute spore-like bodies whose function is not known. They do not infect either the wheat or the barberry. The aecidiospores are incapable of reinfecting the barberry. They can infect only the wheat and a few other grasses susceptible to this particular biologic race. On the wheat the germ-tubes of the aecidiospores penetrate the stomata of the leaf and stem and produce local colonies of mycelium which gives rise to uredospores (Fig. 3514). These are one-celled spores which are produced in many generations and which serve to propagate and spread the fungus during the summer. To them the rusty appearance of infected grain-fields is due. They can reinfect only wheat and the other graminaceous hosts of the fungus but not the barberry. Toward autumn the same mycelium which produces uredospores during the summer gives rise to teleutospores. These occur as black streaks and patches on the stems and leaves, upon which they remain during the winter. In spring the teleutospores germinate in place and produce short germ-tubes termed promycelia from which four minute sporidia are abjoined. The sporidia are

borne away by the wind and when they alight on the barberry the aecidia are again produced. The sporidia do not reinfect grain.

Puccinia graminis represents the complete life-cycle of a rust of the most complex type. Rusts of this character, which alternate regularly between two hosts, are said to be heteroecious. Those which produce aecidiospores on the same host on which the other spore forms are borne, are said to be autoecious. Not all rusts have the entire complement of spore forms, one or more of which may be dropped from the cycle. Thus, neglecting the pycnosporangia which, so far as known, have no significance in the life of a rust fungus, the red cedar rust (*Gymnosporangium*) has aecidiospores on the apple and teleutospores on the red cedar; the hollyhock rust (*P. malvacearum*) has only teleutospores which germinate immediately or which may survive the winter and reinfect plants in spring; the blackberry rust (*Gymnoconia*) has only aecidiospores which germinate like teleutospores. Many rusts, like some of the grain rusts, are able to maintain themselves by means of uredospores which are capable of enduring the winter. This method of persistence through unfavorable seasons must be considered as a special and accidental adaptation to particular conditions, for it is not likely that any form of rust has become permanently reduced to the uredospore stage since this is merely a propagative spore-form of little morphological significance. Continuous uredospore production is likely to occur where plants are kept uninterruptedly in a growing condition like carnations in greenhouses, or fig trees and species of *Vitis* in tropical and subtropical regions. Under such conditions teleutospores are produced with comparative rarity.

Some common rusts.

The following are some of the common rusts on horticultural plants:

Uromyces caryophyllinus, the common carnation rust, occurs on several members of the pink family but is known in America chiefly in its uredo stage on the carnation upon which teleutospores also are sometimes found. Different physiological races occur on various members of the pink family, some of the European forms on tunicas and on saponaria have aecidia on *Euphorbia Gerardiana*, but in America the aecidial stage of the race on dianthus is not known. The presence of the fungus is indicated by the appearance of lead-colored pustules which appear first on the lower leaves and stems of the plants. The pustules soon rupture and discharge sooty powder made up of uredospores. These are blown or carried by spray to other plants. For germination of the spores a thin film of moisture such as that produced by dew is necessary. Avoidance of conditions which favor the germination of spores will tend to decrease the rust, but only such remedial measures as have been mentioned above can be suggested.

Uromyces appendiculatus, on bean, cowpea and related genera. Sometimes causes damage but not common. Aecidia and uredospores on the leaves, teleutospores mostly on the stems, on which they remain during the winter. The infected material should be destroyed.

Uromyces pisi produces its uredospores and teleutospores on the pea. The sporidia produced by the teleutospores infect the dormant buds of the subterranean shoots of *Euphorbia Cyparissias* in which the mycelium becomes perennial. From the infected rhizomes deformed shoots arise, on the leaves of which aecidia are borne.

Puccinia asparagi has all its spore-forms on *Asparagus officinalis*. This is the most serious parasite of the garden asparagus. It was first noticed as a menace in the eastern United States in 1896. It has since spread over the entire country. As a result of its ravages the system of asparagus-growing has been greatly modified in some regions while in other sections the commercial cultivation of asparagus has been practically abandoned. The palmetto varieties appear to be somewhat resistant to the disease. Sprays of sulfur-soda soap, and of bordeaux mixture, and dusting with sulfur in dry regions have proved more or less successful. Ornamental species grown in the United States are not affected by this rust.

Puccinia graminis, the black rust of cereals and grasses, while of great importance agriculturally is of interest to horticulturists only for the reason that the aecidial stage sometimes disfigures the leaves of *Berberis vulgaris* planted for ornamental purposes.

Puccinia malvacearum, the hollyhock rust, has only teleutospores which are produced in successive generations. The teleutospores produced during the summer germinate immediately and rapidly spread the rust. In regions where the winter is not too severe, those produced late in the season sometimes survive the winter, but in the northern states the fungus lives through the winter in the mycelial stage in the stems and petioles of *Malva rotundifolia*, on which developing sori can be found during the entire season. Destruction

of wild hosts and of diseased portions of plants is a partly successful method of control.

Puccinia chrysanthemi, the chrysanthemum rust, is known in the United States chiefly in the uredospore stage on chrysanthemums of which only some varieties appear to be susceptible. The rust rarely produces serious damage, and is readily controlled by the elimination of susceptible varieties.

Gymnosporangium juniperi-sirginianæ, cedar rust, apple rust. The telial stage produces the galls known as cedar apples on the red cedar. After rains in spring the teleutospores ooze out from the galls in the form of horn-like gelatinous masses, an inch or more in length. They germinate in place and the sporidia infect the leaves and fruits of the apple on which the aecidial stage is produced. No appreciable damage is caused to the cedar, but apple trees are sometimes defoliated by this rust and the damage to orchards is often extensive where cedar trees are abundant. Removal of cedar trees prevents the occurrence of this rust on the apple. The fungus can be controlled also by spraying with bordeaux mixture.

Gymnosporangium globosum, another species much like the foregoing, is the common cause of apple rust in the East.

Cronartium ribicola has uredospores and teleutospores on various species of currants, but is chiefly of importance on account of the destructiveness of its aecidial stage to the white pine and other five-leaved pines. Introduced from Europe probably about 1906. Local in northeastern United States at present.

Coleosporium solidaginis occurs on aster, solidago, and other Compositæ. It is chiefly of interest because it also attacks the cultivated aster (*Callistephus hortensis*) causing considerable damage. The aecidial stage occurs on pines. The intervention of this stage is, however, not essential for the maintenance of the fungus since the uredo sori persist through the winter on the rosette leaves of solidago and other Compositæ.

Melampsora tremula is the common orange rust of poplars in the United States. Several races exist which have aecidia on larix, pine, and other plants. Numerous other species or subspecies of *Melampsora* occur on willows. The injury caused by these is not great.

Gymnoconia interstitialis, of the blackberry, has but one spore form, the aecidiospores which germinate like teleutospores. The rust is exceedingly common on the blackberry and raspberry covering the whole under surface of the leaves with blisters which burst and display the brilliant orange spore-powder. The mycelium is perennial and permeates the entire host. No satisfactory remedy has been suggested.

Uredo fici, an unattached uredo-form which is common on fig trees, causing a rusty brown appearance and premature falling of the leaves. Where figs are grown for fruit, considerable damage results to the crop from the loss of leaves. Common also in the tropics.

HEINRICH HASSELBRING.

RŪTA (classical name of rue). *Rutæceæ*. Perennial, glandular, punctate herbs, hardy or half-hardy North, quite hardy South but of no great horticultural value.

Plants often woody at the base, with terete branched sts.: lvs. alternate, simple, 3-foliate, pinnately cut or compound; fls. in leafy-bracted terminal corymbs or panicles, numerous, yellow or greenish; calyx short, persistent, 4-5-lobed or parted; petals 4-5, limb arched,

often dentate or ciliate; stamens 8-10; ovary sessile: caps. 4-5-lobed, the lobes indehiscent or dehiscent at the apex.—About 40 species mostly in the Medit. region and a few in W. and Cent. Asia.

graveolens, Linn. RUE. HERB OF GRACE. Fig. 3515. A hardy perennial, woody at the base, 1½-2 ft. high; lvs. fragrant, much divided; lobes oblong, the terminal obovate; fls. yellow. July.—Prop. by division and seeds. An old medicinal plant, with a very strong aromatic odor; sometimes spontaneous in this country.

Patavina, Linn. (*Haplophyllum Patavium*, Hort.). A hardy perennial herb 4-6 in. high: lvs. glabrous, the lower oblong-spatulate, narrowed at the base, the others trisected and lacinate: corymb dense; pedicels somewhat longer than the fls.; fls. golden yellow. June, July.

F. W. BARCLAY.

F. TRACY HUBBARD.†

RUTABAGA: *Brassica*.

RYE: *Secale*. R., Wild: *Elymus*.

RYNCHOSPORA (Greek, *snout* and *seed*, alluding to the beaked achene). Also spelled *Rhynchospora*. *Cyperaceæ*. Chiefly perennials, with more or less triangular and leafy culms; suitable for bog or lowland planting, but rare in cultivation.

Inflorescence terminal or axillary: spikelets paniced or variously clustered, ovate, globular or spindle-shaped; scales open or barely concave; perianth of bristles; stamens mostly 3; achene lenticular, globular or flat, crowned with a conspicuous tubercle or beak.—About 300 species, distributed in the tropical and subtropical regions, many in Temp. N. Amer. and a few in Temp. Eu. and Asia.

alba, Vahl. Culm slender, about 6-24 in. high, triangular above: lvs. narrowly linear, almost bristle-form: spikelets lanceolate, white or whitish, densely crowded into a head-like terminal corymb. Bogs, Newfoundland to Alaska southward to Fla., Ky., the Great Lake region and N. Calif., also in Eurasia and Porto Rico.

fusca, Ait. f. Loosely stoloniferous, culm 8-24 in. high: lvs. bristle-form: spikelets ovoid-fusiform, chestnut-color, clustered in 1-4 loose heads, overtopped by the slender bracts. Boggy places, Newfoundland to Ont., southward to Del. and Mich., also in Eu.

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3515. *Ruta graveolens*. (Flower slightly enlarged.)

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